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APPALACHIA.

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The Annual Address of the President.

BY CHARLES E. FAY.

January 8, 1879.

In proceeding to the presentation of the customary annual address, it might be the part of discretion to make no reference to the manner in which the same duty was performed by my honored predecessor. A man of science of recognized standing, he read before you on that occasion a paper of such merit for the large amount of accurate information which it embraced, as to cause it to be at once sought for by the encyclopedist for presentation to a larger public in a manner comporting with its scientific value. Mindful that his successor was chosen for the reason that he is not a man of science, but to emphasize the fact that our Club possesses a dual nature, I shall not make the futile attempt to follow that excellent example. I shall not hope to present new facts of scientific value, either self-observed or wisely collated. Nay more, I deliberately turn from the world of physical realities to wander in the region, if not of fancy, at least of things less tangible.

I purpose to consider a subject relating to our Club upon the æsthetic side; to discuss briefly the various pleasures we experience as we ascend these grand monuments of Nature and stand upon their breezy summits; to furnish if possible, an adequate answer to the surprised query often put to the enthusiastic mountain-climber by those content with the emotions

of lower levels: "What pleasure can you find in repeated ascents of mountains so slightly distant from each other?"

Permit me first to present my subject in a concrete and readily recognizable form.

On a clear August morning a party of avowed lovers of these delights, bent upon the ascent of a noble mountain, find themselves assembled at their rendezvous beside the famous cascades of one of its ridge-born streams. In straggling groups of two or three many of us have come thither over the broad, fertile intervale, crossing the intervening river by a rustic bridge that temporarily spans the contracted bed of the yet boisterous stream. We have passed the white stretches of rubble beyond, under the shadow of elm and maple, through the tall ripening grasses, skirting the nodding fields of glistening corn, up the little briar-clad bluff that hems the western edge of the intervale, across the dusty highway, through the slow swinging gate and along the pasture road, which at once entering the woods brings us anon to a little clearing and our cascades.

Such is the prelude of a day of combined toil and pleasure. And now we begin the ascent, still in groups, yet in the earlier portion of the way with a tendency to keep together in larger numbers. The path ascends sharply by an old logging-road, whose scar, all healed, is hardly perceptible upon the face of Nature; now through the woods, now through the scrubby clearings of the broad ravine. The spirits rise as the way, the merry anecdote is told, laughter is frequent, and all reaches its climax when, having abruptly turned aside from the fading road, we strike up the long forest-clad slope at an angle of thirty-five degrees. The muscles no longer perform their work in a perfunctory way. The will, a cheerful master, bids them exert themselves. As cheerfully they respond, and the sceptre of the intellect is wholly given up to sprightly wit as, with many a strain and many a slip, the party toils upward through this steep belt, which might almost be called the region of perpetual jest.

In time it is passed and we emerge from the wood upon the bare ledges interspersed with patches of heath and mountain

grasses. For the first time the prospect opens, the beautiful valley following the bending river for miles, the many features of the vale, its groves, its farms, its villages, all embraced in a glance as upon a wonderful outspread map, the despair of the topographer. Beyond are the familiar forms of the nearer mountains seen in new aspects and more comprehensible, and, rising as we rise, new peaks appear in ever more distant planes. The horizon is retreating. Have you noticed the change that has come over the spirits of the party? As if by tacit consent it has again dissolved into smaller groups, and many prefer to be alone. The jest, the laughter have grown infrequent. The cries from one to another are more for the sake of calling attention to this or that new feature appearing in the prospect. The way is actually far easier than in the portion through the woods, lying as it does over stretches of bare ledge at an easy angle, but the muscles, though still capable of long effort, do not perform their work with the same alacrity. The wish to enjoy the prospect becomes the pretext for repeated halts. The physical man is toiling alone. The intellect is busy with other matters. The attention is divided. The will acts with less vigor.

A glance upward to where others of the party from loftier heights look upon more than we can see, proves a new stimulant, and again we mount. Farther and farther the horizon recedes. Mountains piled beyond mountains, fainter and fainter in the more distant planes, awaken the sense of the infinite, the sentiment of the sublime. The sky, which by day at least can never seem farther away than the most distant object in our horizon, seems now to vindicate its right to be to us the type of the infinite in space. At length we ascend alone the final peak of our mountain. Even the joyous sense of victorious accomplishment is lost in the thrill of exaltation which completely fills us, as the hitherto hidden quarters of the horizon suddenly are revealed to us. How we regret that the human soul is incapable of long enjoyment of these exalted moods! Those who have arrived before us, have passed this phase and are now discussing the identity of this peak or that pond; others are eating their lunch and are merry. For a

time they are a jarring influence. But we have enjoyed these noble satisfactions before and hope to many times again. Soon we too become social and join in the identification, eating, and merriment.

In this hardly idealized sketch of one of the excursions which helped to render our last summer's field-meeting at North Conway so delightful, while I have not hinted at all the pleasurable incidents which the aseent of Moat Mountain afforded, I have aimed to give prominence to four categories into which all would doubtless fall,— the simply physical, the social, the intellectual, and the emotional, or moral. I have endeavored also in passing to suggest, what seems to me not wholly fanciful, that each of these has its milieu, or at least a region where it is in the ascendant; so that the mountain slopes might almost be divided into corresponding zones of pleasures as our President-elect has divided them into their zones of physical features.

Of these categories, the two former, the physical and the social, will claim but passing attention, inasmuch as these pleasures are not so characteristically different in the ascent of mountains from what they are when experienced in the valleys. And yet the pleasure which we derive from the mere play of the muscles, the expending of energy that is stored up with great facility in the mountain air, is naturally much greater in this sharp exercise, than when it is slowly spent in the aimless ramble. In the wooded belt where the mind finds so little to distract it from the work of mere ascent, it is almost a delight to keep on to the point of temporary exhaustion, for the sake of experiencing with what haste nature restores the spent vigor in the brief period of rest. So, too, the delights of social intercourse seem to me to possess a greater piquancy when accompanied by this exhilarating tension of the physical man, to say nothing of the ennobling reflex of the moral exaltation.

I desire to dwell upon the intellectual and moral pleasures of mountaineering. I would define intellect for my purpose as that portion of our nature which desires to learn and delights in knowing; whose pleasures therefore are in cognition and recognition. Of these the former as a prime function of in-

tellect is active; the latter rather passive. The one is oftenest the reward of eager seeking; the other the unexpectedly paid interest upon a fund of knowledge acquired. Let us consider how the ascent of mountains affords to each its proper opportunity.

The pleasure which we derive from the acquisition of knowledge, even if it be of mere disconnected items, is a matter of commonest experience. In the ascent of mountains opportunity is granted not only to acquire those items which delight the student in the various departments of natural science, but especially to increase our fund of geographical information. I think it hardly possible to exaggerate the degree of interest which this kind of knowledge has for the human mind in the present day. It is attested, not only by the vast extension of the library of travel, but particularly by the rise of a multitude of geographical societies, with large and enlightened constituencies, wealthy some of them, and annually disbursing large sums in the encouragement of explorations that shall add to a knowledge of the world by its inhabitants. Of kindred origin with these are the alpine and tourist clubs, which enroll in their membership in Europe alone twenty thousand professed votaries of mountaineering. These differ from the geographical societies less perhaps in the seriousness of their purposes than in the fact that they are largely composed of those who know by experience, and satisfy in a measure, the longing to unveil the hidden which characterizes the explorer upon a grander scale. For to this longing these mountain forms appeal most powerfully. What that distant, hazy, half-transparent summit itself may be, what it looks upon, what lies between us and it, are among the questions that stimulate the almost irresistible desire to ascend it. It would be unjust to set this feeling to the account of idle curiosity. Curiosity it may indeed be, but it is that same wisely implanted impulse which needs to be but slightly directed to become the scientific spirit.

In proof of my position I would cite the significant fact that this passion for mountains is something quite modern, and that it was developed simultaneously with modern science and has kept pace with it. As far as we are able to judge, the ancients

were not devoted to æsthetical mountaineering. If mention is made of these impressive natural features in their literature, it is from the point of view of him who lifts up his eyes unto the hills. Their strength, their mass, their sky-piercing altitude, the chase of the cloud-shadows up their slopes furnish the poet his oft-repeated epithets and similes, but none, as did Schiller and Wordsworth, ascend them for a new and deeper inspiration. They are the rugged place of refuge for the terror-stricken, defenceless fugitive, the hated barrier to the invader, and by no means the school of the philosopher. The very nature of their experience with them tended to deepen the impression that these stupendous forms were inimical to man. In mediæval times, as we can well conceive, the constitution of society rendered delight in these interviews with Nature an impossibility. Later the stimulus of the revival of letters and the tendency to a general improvement of the social condition, led to those bold explorations over seas, which gave to monarchs a new continent, and to adventurers an El Dorado. Long after the sea had lost its terrors the mountains were still left to their solitary grandeur. It was not until the human intellect had been stimulated anew by its increasing successes in its study of the world of matter, that this inherited awe was forever dispelled. The study of natural science inevitably led man face to face with Nature. As a rich reward for him who in the fullness of time turned to her not only with the soul but the understanding, she revealed the glory of her visible forms in forest, wild ravine, and cloud-draped mountain top. As late as 1741 Switzerland, to-day the Mecca of thousands of *alpinistes*, was visited only for its lakes. The name of a naturalist, whose scientific zeal was equalled by his love of mountains for their own sake and by his adventurous spirit, is indissolubly connected with the initial event from which we may date the growing passion for ascending lofty mountains — the ascent of Mont Blanc in 1786.

I cannot refrain from quoting here a sentence from De Saussure's diary. It cannot fail to strike a sympathetic chord in the heart of many of you who, after long delay in accepting the challenge of some far-off peak to unveil its mysteries, have

at length yielded and have had your reward. The great exploration finished, he writes: "nous revînmes à Genève, d'où je revis le mont Blanc avec un vrai plaisir et sans éprouver ce sentiment de trouble et de peine qu'il me causait auparavant."

But the pleasures of recognition are scarcely less vivid, and probably enter even more into the aggregate of satisfaction which we take in our repeated visits to neighboring peaks among our Appalachian mountains. Though one is very much like another in its general characteristics, while the experiences of the different ascents present no great variety, while the prospects they afford contain the same or similar features, yet they do not lose their charm for us. In addition to the fact that in new cognitions they are never actually exhausted, any more than an oft-read master-piece of literature, they are constantly re-presenting to our minds objects and facts previously acquired yet rarely met. In this perchance unlooked-for recognition lies the source of much pleasurable emotion.

In my prefatory sketch I endeavored to suggest this pleasure by my frequent references to identification. Through this act we are constantly receiving it. A sufficient evidence lies in the very frequency with which we hear during an ascent with a party: "Why, there is ——!" Indeed the experience of many will attest that the ascent of a mountain in a strange country is deprived of an appreciable fraction of its enjoyment by the lack of this very element. Mr. Grant Allen in his work on "Physiological Æsthetics" recognizes this as an element of æsthetic pleasure. He says: "Country walks are rendered far more interesting if we know the various surrounding landmarks, and can identify hill and cape from different points of view. In short, everything that suggests the idea of knowledge and comprehensibility is pleasing." Besides the mere sense of acquaintanceship, there is superadded in the process of identification, at least in the ascent of untried mountains, an element of intellectual conquest. The recognition of single peaks amid the throng, far from being the result of a glance, may require much study and many a combination of known facts before we rest in certainty.

This is, however, but one of the ways in which these excursions furnish the pleasure of recognition. The specialist in

natural history catches a pleasurable glimpse of some known alpine or sub-alpine flower or insect; the geologist hails new illustrations of general laws; the person of literary tastes with mind well stored from favorite authors, comes with delight upon some spot or scene that the poet must have had in mind when he gave utterance to this or that familiar line. There is no one who leads in any way or in any degree the intellectual life who is not the recipient of pleasure from this source.

But the existence of a nobler pleasure which has been spoken of as the emotional or moral is as real as the other. Doubtless different natures are variously susceptible thereto, but that man is to be pitied who is so entirely climbing for the sake of saying that he has done it, or who is so engrossed in the pursuit of ulterior scientific aims, that he is a stranger to the thrill of emotion as he rises above the higher spurs and at length stands forth upon the summit; who cannot enter into the spirit of those lines of Wordsworth, when, portraying the soul of his contemplative young "herdsman on the lonely mountain tops," he writes:

"He looked —
Ocean and earth, the solid frame of earth
And ocean's liquid mass beneath him lay
In gladness and deep joy. The clouds were touched,
And in their silent faces he did read
Unutterable love. . . . Sound needed none
Nor any voice of joy; his spirit drank
The spectacle; sensation, soul and form
All melted into him; they swallowed up
His animal being . . . they were his life.
In such access of mind, in such high hour
Of visitation from the living God
Thought was not; in enjoyment it expired."

As to him who attempts to fathom the nebular depths, or who in mid ocean retired within himself, lets his eye wander over billow upon billow out to where sea and sky meet in the domed immensity; so the soul, though it be but a little susceptible to religious emotions, can hardly fail in these moments to be conscious of an influence akin to religious exaltation. We call it the sentiment of the sublime. We know that it is awakened when we are brought face to face with the vast, the seemingly in-

comprehensible. Why was it given to man? Shall we consider it the base inheritance of a race from its æons of ignorant terror, destined to be differentiated out of our more enlightened nature in due season? If so let us be grateful that we did not arrive upon the scene too late to experience it.

Though this sentiment is one of those which we are usually content simply to enjoy and not to analyse, it may nevertheless be permitted to attempt to trace the origin of the feeling of exaltation to which I have referred, and to account for this phase of our pleasure in the ascent of mountains. It seems to me that in the mutual relations of the three terms, sublimity, exaltation, pleasure, we shall find a sufficient explanation. Of these the first may exist without the second and third, but the two latter are inseparably united. In other words, if the first give rise to the second, the third will follow; otherwise not.

It is evident that the sentiment of the sublime may be experienced without the accompaniment of pleasure. This is the case whenever the feeling of awe, which enters as an element into that sentiment, becomes exaggerated into fear. Of two persons of different dispositions witnessing a violent thunder-storm, both may be equally impressed with the sublimity of the elemental struggle, but to one it is a source of delight, to the other of painful suspense and apprehension. Similarly the sublimity of profound and giddy depth is notably a source of pain. How perfectly has Shakespeare rendered this in the words of Edgar in King Lear!

"How fearful
And dizzy 'tis, to cast one's eyes so low!
The crows and choughs, that wing the midway air,
Show scarce so gross as beetles: Half way down
Hangs one that gathers samphire; dreadful trade!
Methinks he seems no bigger than his head:
The fishermen, that walk upon the beach,
Appear like mice; and yon tall anchoring bark,
Diminished to her cock; her cock a buoy
Almost too small for sight: The murmuring surge,
That on the unnumber'd idle pebbles chafes,
Cannot be heard so high: — I'll look no more;
Lest my brain turn, and the deficient sight
Topple down headlong."

In this belittling of all things which Shakespeare makes so effective in working upon the imagination of Edgar is to be found, I conceive, the true cause of the painfulness of the experience. Not only does it suggest the distance and fatal issue of the possible fall, but it belittles also the thinking subject, renders him insignificant and weak in his own eyes, and almost powerless to resist the strange fascination of the terrible. The effect produced is the very reverse of that which we have spoken of as exaltation.

This term is suggestive of a strong, reliant self-consciousness. When this attends the experience of the sublime, the latter becomes a source of pleasure. As the consciousness of weakness is attendant upon fear, so here it is a consciousness of power which gives to this experience its character and pleasurableness.

The ascent of the mountain — I mean of course in the only way that is worthy of the name — is remarkably well fitted to develop this sense of power. It is through the exertion of our whole physical strength, by a continuous and successful effort of our will, after a series of victories, as it were, that we have attained to this lofty perch, gazing from which under other circumstances we might have been susceptible to dizzy fear. But there is another, nobler origin of this sense, one more intimately related to the very sources of our impressions of the sublime. Upon the mountain it is not so much the simple elements of profundity, height, distance, that awaken this sentiment, as that of multiplicity upon a scale of surpassing grandeur. Even the impressions of distance are enhanced by the constantly increasing number of planes, but far more effective is the seemingly infinite number of details that go to fill the picture. Taine has somewhere said that the mediæval architects in constructing their imposing cathedrals, seemed to desire to attain the infinitely grand and the infinitely minute ; to crush the soul at once in a two-fold manner, by the enormousness of the mass, and the wonderful multiplicity of detail. If this effect is partially produced in the works of man, how much more completely in the grand cathedral of Nature! But after all the human soul is grander than either. Neither is able really to crush it. Out of the temporary sense of oppression

springs an exultant yet reverent sense of power. It becomes conscious that it is not overwhelmed even by this immensity; that it is endowed with the capacity, grant it but time, to comprehend it all; that while the boundaries are so far away, it is yet able to go out and touch them by the sense of sight; that the increasing sum of details that we are comprehending is an earnest of the ability to make it all our own. In fine, upon the personal element, more or less consciously forming the background of the sublime, depends the pleasure or the pain we derive from its contemplation. The sublime becomes a source of loftiest pleasure through the realization that it is not, by virtue of its vastness, unrelated and foreign to the human soul, but cognate with it, an assurance of its nobility and perchance a prophecy of what it shall be.

I have thus imperfectly succeeded in setting forth the pleasures which the ascent of mountains affords. While giving them a decided preference over those enjoyed in a sojourn in the valleys, I do not fail to recognize the deep satisfaction which the prospect from lower planes and the spectacle of the varying moods of Nature that are daily and almost hourly presented, may inspire. These form for us all the rich background of even the other pleasures. But they are more passive in themselves, and less actively stimulating in their effects. It is very doubtful whether it would have been possible to have brought into active existence a society composed of such as tarry at hotels and boarding houses, or even of such as enjoy rambles along the roadsides and in the valley groves.

There are one or two thoughts that naturally force themselves upon the attention as we consider the character and influence of these pleasures, and remember that our Club stands as perhaps the sole representative on this continent of the interests of æsthetics as related to the realm of nature. May not this association be expected to become a centre of influence in the encouragement of a more general and intimate relationship with Nature, as opportunity so richly offers near at hand. It seems to me our duty as a society to encourage in every possible way a habit of country walks, rambles afoot over the numerous beautiful hills that lie within a radius of ten miles of

Boston, and are so readily accessible. For themselves, for what they look upon, for the healthful and helpful effect upon the rambler, they well repay a visit. They lack, of course, the grandeur of the mountains, they appeal but slightly, if at all, to the sentiment of the sublime, but the cultivating influences of the serene and beautiful, the broadening tendency of the extended, the invigorating refreshment of cheerful exercise they can impart. I know of no better way whereby this habit may be fostered within our own membership than through more frequent excursions like those made during the past year to Blue Hill and to Wachusett, and perhaps the presentation of an occasional paper at our meetings that shall set forth the claims of neighboring view-points upon our attention.

But it is a question whether the Club has not an opportunity to extend its influence as regards the rising generation. Who doubts that the ability to appreciate natural scenery enters as an element into the truest education? Without venturing to suggest the method, it does seem to me within the bounds of the practicable for our society to take the initiative in arranging excursions in which the older classes of the public schools should participate, and furnish them proper instruction in connection with a day's enjoyment of Nature. Neither need our influence be confined to the city and its immediate suburbs. In a stroll with the honored founder of the Club over certain hills in the neighborhood of Lowell, that offered delightful prospects part way up, but whose summits were so thickly wooded as to render an outlook nearly impossible, it was suggested that good results would follow if the owners of the property could be persuaded to clear the top, where this would not require a too wholesale felling of the timber. Better still, if, with the coöperation of the town or individuals, substantial rustic observatories should be erected to overlook the tree-tops. The very existence of such an observatory in a sightly place would attract many visitors from the vicinity and even from abroad.

By a provision of our amended Constitution, it falls to the duty of the Secretary to present at the annual meeting a history of the Club for the previous year. It will be his privilege to refer to circumstances that note a year of activity and bear wit-

ness to no decrease of interest among our members. In view of certain experiences of the past year, I would embrace this occasion to present for your consideration two recommendations of especial interest as affecting the future welfare and character of the Club.

It is much to be regretted that no number of "Appalachia" has been issued since last March. This omission has been occasioned by the lack of funds. Such a publication necessarily involves a considerable outlay, and in the issue of the four numbers that have already appeared, the greater part of all the funds received into the treasury have been spent. The sales returning but a small fraction of the cost, the result has been a constantly depleted treasury. To have published a fifth number would have been to incur a debt equivalent to its cost — an alternative out of the question even had we desired it, under our constitution as an incorporated club. But we cannot afford to permit this state of things to continue. Upon this bulletin we must depend to keep alive the interest of our many non-resident members, and to make known our existence and work to the fraternity of alpine and geographical societies abroad. Already, if we may judge by the favorable mention of the Club and its work in European journals, it has done us excellent service. Some provision should at once be made to assure its publication quarterly, or at the least semi-annually. This can be done only by rendering it largely, if not completely, independent of the annual income of the Club. With so small an annual tax, our income is no more than sufficient to pay current expenses and permit of small annual appropriations to the various departments. A publication fund of three thousand dollars is a desideratum. As the times do not warrant the hope of an early endowment of such a fund, our chief reliance would seem to be upon small gratuities from the friends of the Club, and upon a large increase of circulation at a price sufficient to pay the actual cost of the number. I would recommend the appointment of a special committee for immediately devising ways and means to place "Appalachia" upon a secure, self-supporting basis.

Let me also venture to suggest the expediency of enlarging the Club's activities upon the more technically geographical side. It is, I believe, the only association east of New York that in any way represents this great interest. From its composition it is well fitted to foster this branch of science until such time as the establishment of a New England Geographical Society shall be imperatively called for. As yet our efforts have been chiefly concentrated upon a small section even of the region that gives to our Club its name. We have, however, on one or two occasions had opportunity to listen to reports from places too remote from the Atlantic coast to be comprehended even under our freest interpretation of the phrase "adjacent regions." The interest manifested in these papers has given evidence that our natural field is as broad as the surface of the earth itself. Your choice as my successor of one so favorably known as a specialist in geographical science, and for his zeal in promoting the interests of geographical studies, assures a successful issue for any steps in this direction that shall be initiated under his administration. And now, while thanking you for the kind indulgence and zeal which have rendered a pleasure the administration of an office assumed with many misgivings, let me congratulate you upon the return of the executive office to that branch of our constituency from which the fullest, broadest, worthiest results must ever be expected to flow.

A Trip to North Carolina.

BY F. W. CLARKE.

Read April 9, 1879.

In the summer of 1878, I decided upon an excursion into the mountains of North Carolina. Here the Appalachian System culminates in a wilderness of lofty peaks and ridges, the highest east of the Mississippi, covering an area of more than seven thousand square miles. A dozen of these summits overtop Mt. Washington, and at least sixty exceed six thousand feet in height. Of this remarkable region I had heard much

vaguely, but knew definitely, little; hence my curiosity found me ready excuses for going.

My starting point was Cincinnati. First there was a steamboat journey on the Ohio River, ending at Huntington, West Virginia. Then, after a day lost through the usual failure to make connections, came a ride over the Chesapeake and Ohio Railroad, up the magnificent mountain gorges of the Kanawha River, and across the divide to White Sulphur Springs. Thence to Charlottesville, after a day of laziness, and then due southward to Salisbury, North Carolina, the real beginning of my journey. In these preliminaries, six days had been wasted.

From Salisbury a railroad runs towards the mountains. Its objective point is Asheville; but at the time of my trip there were twenty miles of it unfinished, and upon this portion occurs some of the most remarkable engineering in America. A single passenger train runs each way daily, and contrives to make the distance from Salisbury to the foot of the Blue Ridge, one hundred and eighteen miles, in a little less than seven hours. I left Salisbury at half past seven in the morning, and it was four in the afternoon when I mounted the stage which was to carry me over the Blue Ridge to Asheville.

The Swannanoa Gap, through which the road lay, will always be beautiful in spite of rails and locomotives. It is a narrow valley between high, steep mountains, and the road winds sharply up beside and sometimes almost overhanging a rapid stream. At the time of my visit the woods were full of blooming rhododendrons; and the effect of their rosy masses against the dark green foliage was beautiful in the extreme; but the road was horrible. In a distance of three miles it climbs a thousand feet; and for every foot a gully has been furrowed across it by the waters draining from the mountain side. There were neither ditches nor culverts to protect it from washing; and I may say here that these important features seem to be lacking from every road in this region. Fords are numerous, but bridges rare. Hence, in bad weather, the roads often become absolutely impassable; and the damages of one storm may be reinforced by several others before any repairing is attempted. In three hours the summit of the Gap was reached,

and then came seventeen miles of easy descent to Asheville, over a better road, partly by the side of the lovely Swannanoa River, with occasional glimpses of lofty peaks and rich valleys. The staging, however, was primitive. The vehicle was good enough, and so were the horses; but the driver had conservative ideas, and seemed to regard the smooth parts of the road as equally dangerous with the roughest. Seven hours were spent in walking the whole twenty miles of distance, and it was not until eleven o'clock at night that I found myself snugly ensconced in the Eagle Hotel at Asheville.

Before describing Asheville I ought to say a little about its geographical situation. Although it is the central town of the mountain country, its immediate surroundings are comparatively level, and of the richest agricultural character. All around it are fertile farms, yielding abundance of grain, of fruit, and of tobacco. The valley of the French Broad River, running north and south, throws the mountains away into the distance, and divides the whole region into two distinct halves. To the east lies the Blue Ridge, also running north and south, with its attendant spur of the Black Mountains, the highest of all. Far to the north and west the Unaka or Great Smoky chain divides North Carolina from Tennessee, and here rise several peaks surpassing six thousand feet in altitude. Due north, some fifty miles away, these two main chains approach each other; and here we find the Roan Mountain, a hundred feet higher than Mt. Washington, and with a hotel upon its very top. Southward, the Blue Ridge curves somewhat to the west, and meets a number of lofty parallel chains which connect it with the Smokies. Among these ranges the Balsams nearly rival the Blacks in height, and the Nantahala and Cowee Mountains are by no means contemptible. Nearer Asheville, between it and the higher Smokies, is the Newfound Range; and nearer still rises the shapely peak of Pisgah. Unlike the White Mountains, nearly all of these ranges are wooded to the summit, and deeply covered with rich soil. Cattle roam over them in great numbers, and farms sometimes creep well up the mountain sides. Some of the cornfields are literally set up on edge, and seem almost ready to topple over into the valleys below.

Asheville itself is a prosperous town of about twenty-five hundred inhabitants; and, but for the occasional chimney reared southern fashion against the outside of a house, it might easily be mistaken for a New England village. Soon, two railroads will meet there; one running east to Salisbury, the other down into South Carolina. Another road will eventually descend the valley of the French Broad River, and connect with the railroad system of Tennessee. Thus, as a centre of travel, and as the chief town of a rich and rapidly developing agricultural and mineral country, Asheville cannot fail to thrive. Also, as a place of resort and as a point from which other resorts may be reached, its future seems certain. Its height above sea level, 2250 feet, guarantees pure air; and the climate is admirably suited, both summer and winter, to the needs of consumptives. The scenery about the town is of the loveliest character. All around rise high ranges of distant blue mountains; and from Beaucatcher Hill, only a mile away, an extended view of the most superb kind is easily attainable.

For a couple of weeks I made Asheville my headquarters, and the starting point for several excursions. Two of these it may be worth while to describe.

About twenty miles from Asheville is Bald Mountain; an easterly spur of the Blue Ridge about 4000 feet in height. As a mountain it is nowise remarkable; except that instead of behaving quietly and sedately as a respectable mountain ought, it occasionally indulges in rumblings and explosions of a somewhat alarming nature. For several years the newspapers have been publishing sensational accounts of the "North Carolina volcano"; and correspondents whose imagination was greater than their scientific knowledge, rushed before the public with the wildest speculations about the strange phenomena.

One pleasant morning a party of five of us chartered an open mountain wagon (here called a hack), and started for the scene of action. At first, our route was through a prosperous farming country, where were abundant evidences of thrift and industry on the part of the inhabitants. These were a substantial people differing in no essential respects from the farmers of the Northern States. There were slight peculiarities of

dialect to be noted, no doubt; and the farms may not have been quite so carefully cultivated as if they had been nearer good markets; but these differences were altogether of a minor sort. As we approached the mountains the road gradually ascended, and at about three in the afternoon we reached the summit of Hickory Nut Gap, 2900 feet above sea level, and thirteen miles from Asheville. The scenery now became majestic; we were crossing the Blue Ridge, and the road descended rapidly between high mountains, following down the course of a rushing torrent thickly overhung with blossoming rhododendrons. Now and then a log cabin broke in upon the harmony of the scene with its rough exterior and unkempt surroundings, too squalid to be picturesque. In eight miles the road descended 1800 feet; and the last mile was between lofty precipitous walls of solid rock, rising in some places almost vertically from the swift stream which had carved out this mighty gorge. On our left lay Bald Mountain, splintered and jagged from summit to base. On the right, across the river, rose Chimney Rock, flanked by a long perpendicular precipice a thousand feet in height, over which fell a thin ribbon of water barely discernible by the light reflected from its surface. This little stream, seeming so insignificant from below, runs a grist mill which is placed only about a hundred yards above the fall. Soon we emerged from the great ravine, and half a mile below its mouth we put up at a small hotel; an unprepossessing place externally, but one which gave us fair shelter and accommodations.

All along the road we made inquiries about the alleged volcano. Everybody had heard the noises, and the different accounts tallied perfectly. Sounds like distant thunder had been heard coming from Bald Mountain, and cracks had formed upon its sides; but no true earthquake tremors and no volcanic symptoms had been detected. It was plain that something must be going on — but what?

Early in the morning we started afoot for the scene of the latest disturbances, a rocky spur of the mountain about a mile from the hotel. From Foster's farmhouse, at the foot of this spur, we first saw clearly the nature of the ground. The entire

rocky face of the mountain seems to be breaking away from the main mass, and to be sliding gradually downward. In this fact is to be found the explanation of all the phenomena.

At Foster's we secured an intelligent guide, and began our ascent. In a few moments we reached a squatter's cabin which deserves to be described. It was perhaps twenty feet square, of one room, built of logs, with a rough doorway, and a small hole for a window. Between the logs were crevices several inches wide, entirely open to the weather. The floor was of bare earth, and the door merely a few poles withed together. For furniture there was almost nothing; the beds being made of rough poles braced against the walls of the cabin. In this miserable shelter, summer and winter, eleven persons, men, women, and children, black, white, and speckled, live. Such abodes are rare, even here; and yet a friend tells me that he has seen just such another one with a patent lightning rod reared against it.

A sharp climb of less than half a mile brought us to a region of fallen rocks, heaped together in the wildest confusion. Here we found a cave which was only discovered about two weeks before our visit. At the foot of a great cliff was a small crevice, through which we crawled upon our hands and knees. This opened into a rocky chamber, about eighty feet long, fifty high, and ten or fifteen wide. Beyond this, and at right angles to it, was another similar chamber, closed at its farther end by a wall of rock a dozen feet high. Past this obstacle we could not penetrate without ladders; nor did we explore several lateral passages which, according to our guide, were of no special importance. At the farther end of the first chamber a sort of "window" opened out upon a shelf of rock half way up the face of the cliff; and from this we could see distinctly the true character of the place. The rock is a fine-grained gneiss, which in the process of sliding has been cracked and fissured in every direction. These cracks and crevices represent three distinct systems; first, a series of breaks at right angles to the plane of stratification, evidently formed by strains which occurred in sliding; second the splits between the several layers of the rock; and third, cavities left by the falling of one mass of

gneiss against another. The cave itself comes under the last heading. One immense sheet of rock has slidden over that immediately beneath it, and become propped up at an acute angle against its former bed. The roof of the cave is sharply angular, its floor is covered with fallen masses of rocks, and over both bottom and sides are thick layers of perfectly dry dust, formed by the grinding of the gneiss to powder. Clouds of this dust might easily be mistaken for volcanic smoke by an inexperienced witness. Through the cave a constant stream of air is circulating, so that the internal temperature is several degrees lower than that of the outside atmosphere.

Leaving the cave, a very steep scramble of half a mile brought us to a crack, recently formed near the summit of the mountain. The first reports of this crevice were grossly exaggerated; it having been described as seemingly bottomless. In point of fact this crevice is perhaps a hundred feet long, not over seventy feet deep and very narrow. It has been explored from end to end, and is plainly but another illustration of the sliding process which characterizes the whole rocky spur. In short, the so-called volcano is nothing but a huge rock slide, of a highly interesting character. Whenever a movement of the rocks takes place, the uppermost sheet of gneiss undergoes strain, and is fractured. A noise naturally accompanies this breaking, and if the rupture occurs near or over a large cave or crevice, the latter serves as a resounding chamber and intensifies the sound into a thunder-like roar. Doubtless the general earthquake shocks which are felt in all parts of our country tend to facilitate the sliding of the gneiss, but, beyond this, earthquakes have nothing to do with the phenomena.

We now found ourselves about a thousand feet above the valley, with a grand view across the lowlands before us. By another route we rapidly descended, passing on our way, near the summit of the mountain, a small field of corn and cotton planted together. I doubt, however, whether the cotton could ever mature in so unpromising a place. We reached the hotel in time for dinner, and late in the evening we got back to Asheville, thoroughly tired, but perfectly satisfied with our excursion. The trip certainly repaid us in point of scenery,

and Bald Mountain was well worth visiting, even though it turned out to be no volcano.

About a week after the Bald Mountain expedition it was proposed to visit Big Craggy; a lofty summit adjoining the Blacks. A party was soon made up of three from the original quintette and two others; a wagon and driver were engaged, and off we started. Four of us were to climb the mountain, while the fifth went to fish for trout. He fished; and these two words sufficiently describe his achievements.

For twelve miles we followed the regular stage route towards the Swannanoa Gap, and then diverged upon a rough road leading up between the Blacks and Craggy. The mountains gradually open higher upon both sides; the loftiest summits rose closer and closer before us; the muddy North Fork of the Swannanoa dwindled to a clear and rapid brook; and at the end of seven weary miles of jolting we reached a place of shelter. Here, almost at the extreme end of the road, and about a quarter of a mile apart, are two houses; one, Patton's, the regular stopping place for parties intending to climb Black Mountain; the other, Glass's, a sort of rival hostelry at which we took up our temporary abode.

The place was decidedly primitive in its character. Imagine if you can, two log cabins, each about twenty feet square, connected by a somewhat narrower platform, and all covered by one roof. The right hand cabin served for a kitchen; the other being divided into two chambers in each of which were two seemingly comfortable beds. These chambers were given up to our party; the family occupying, during our visit, a rude loft overhead.

Late in the evening we went to bed. But sleep came not readily to our eyes. I, for one was strangely nervous, and tossed from side to side in uncomfortable wakefulness. Midnight came and went, and then I discovered that two of my companions were also sleepless, although neither of us had up to that time spoken, for fear of disturbing the others. We arose, held council of war, lighted our remnant of candle, and began to study entomology. Here our opportunities became magnificent. There were the agile flea and the industriou

cimex, in squads, companies, and regiments. Let me draw a veil over the painful scene. Gore was shed that night, and the field of battle was strewn with corpses.

At last morning came, ushering in a day of almost perfect clearnesss. Before us, with marvellous distinctness, towered the bold, sharp crest of Big Craggy, a temptation and a promise to our eyes. It had been arranged the night before that we were to start early, with Glass for a guide. The distance, according to his estimate, would be about five miles, and we could ride on horseback almost to the top. Alas that we ever put our trust in such a guide! If we had ascended independently on foot, all would have been well; but we put faith in him and suffered the consequences. He proved to be utterly incompetent.

We began our day unpropitiously with a series of delays. A horse had to be shod; a saddle must be borrowed from a neighbor a mile away; and so on. It was half-past nine before we got fairly under way, two on horseback, two mounted on mules, and Glass himself on foot. For about three quarters of a mile we followed a rough wood road, and at its end we struck into the forest. Here a blazed trail led up the course of a swift mountain brook, between the main mass of Craggy and a spur of the Blacks. At first, the trail was very blind, and our guide managed to loose it for a while; then it became plainer, and easy to follow. Soon came a rude interruption. My mule, which had been peaceful enough hitherto, suddenly became excited. He stopped, pawed the ground, tried to paw his own nose, then turned to the right about and started off at full gallop on the back track, over fallen logs and loose stones, through underbrush and thickets, without reference to the path, in a thoroughly demoralized condition. In time I managed to pacify the creature, who had a good excuse for his actions. The two in front of me had stirred up a hornets' nest in passing, and my poor beast got the full benefit of their anger. I myself escaped with one slight sting; but the mule was covered with great bunches which testified to the suffering he had undergone. Fortunately, no serious mischief was done, although the rider does not care to repeat the experience.

Having reorganized our forces, we flanked the enemy, and again marched on. The path now became picturesque, leading through an almost ideal forest, among huge trees, past overhanging masses of rock, around thickets of rhododendrons, beside the tumbling brook. Tulip trees, six feet in diameter; chestnuts and oaks of nearly equal size, rose with tall straight shafts on every side. In features of this kind the mountains of North Carolina far surpass the more famous ranges of Vermont and New Hampshire. Although evergreens are scarcer, there is here a much greater variety of deciduous trees, and these assume the most massive proportions. About four miles up, we came to a deserted mica mine; and here a brief halt was made. Mineralogically the place was not very interesting; there being visible but ordinary specimens of a few common species. The great mica mines of North Carolina, mines which exhibit traces of mound builders' working, are fifty miles north of Asheville, and are remarkably rich in rare minerals. Unfortunately I could not visit these localities, so that I was glad to see even an inferior example of this kind of mining.

Beyond the mica mine the path became steeper, and more obscure. Frequently we were obliged to dismount and lead our animals over bad places; and it was not long before we hitched them permanently and pushed on afoot. Soon we caught a glimpse of the summit far away to our left, at least three miles distant; or two miles farther than Glass had led us to expect. An explanation was demanded, and this proved that our guide knew almost nothing about the mountains, and that his five miles was merely to the top of Balsam Gap, a point of no special interest which we easily reached. Here was an open, grassy field and a spring of water; by whose side we swallowed the meagre store of provisions which had been provided for our lunch.

Balsam Gap is merely a depression in the mountain ridge connecting Craggy with Black; so that it was only necessary for us to follow up the crest in order to reach the summit at which we were aiming. The travelling was easy enough, with no steep places, through very open beech woods free from undergrowth. The ground was covered with waist high grass,

through which, in every direction, paths had been trodden by the cattle pastured upon the mountain; and thus our way was made comparatively plain. Along this grassy ridge we trudged for about a mile, before we met another adventure. Then an ominous rattle warned us of danger, and a glance to one side showed us the snake stretched out at full length upon a sunny rock, wide awake, but not inclined either to retreat or to be aggressive. A revolver bullet soon made his snakeship a specimen suitable for study, and his eight rattles were carried away in triumph. He was forty-two inches long by two and a half in thickness when dead, but at least ten times these dimensions when living. Snakes and fishes always shrink when captured. In these mountains, rattle-snakes, though not quite as plenty as blackberries, are by no means rare. Occasionally a den of them is found, in which hundreds of the reptiles are congregated together; but cases of this sort are exceedingly uncommon.

A little farther along we emerged from the woods, and came out upon the bare ridge. The highest peak of Craggy was still more than a mile away, and a minor summit a little under six thousand feet in elevation, was not reached until four o'clock in the afternoon. The question of time now became formidable. It was plainly impossible for us to get to the top and return to our animals before dark, and still we did not want to retreat with our task unfinished. Finally, this compromise was effected. Two of my companions, who had never before climbed a high mountain, were to finish the ascent and then descend on foot, "across lots," by the most direct way. My other companion, with the guide and myself, were to return to the animals and take them safely home. As for the view, we had already seen all there was to be seen, so that we lost nothing in this regard. Close by rose the lofty ridge of the Black Mountains; while in all other directions a sea of blue ranges and valleys, every one unfamiliar to my eyes, stretched away into the dim distance. Only the element of water was lacking. A single lake or broad, winding river would have made the scene well nigh perfect.

So our party divided; one half pressing on to victory, and the other beginning a retreat. We travelled along rapidly enough on our return, the guide leading, while my companion and myself followed blindly. Gradually the path descended, and we soon re-entered the region of trees and tall grasses. We should have been approaching Balsam Gap, when suddenly my attention was called to a thicket of moosewood, (*dirca palustris*), a shrub which I had not seen during the ascent. My suspicions were aroused; I hailed the guide, and by dint of close questioning, speedily developed the fact that he did not know where he was. In short, he was lost; and as for my travelling companion, who had never been in a mountain forest before, he was as helpless as the guide. Fortunately, I had not lost my bearings, and was at once able to point out the proper direction. The guide, however, insisted upon going in exactly the opposite way, but after several futile experiments in favor of all the points of the compass, he owned up that he was thoroughly lost, and went according to my orders. The result was that we reached Balsam Gap an hour late, and got to the animals just at twilight. If we had blindly followed our guide we should have found ourselves at nightfall well down on the wrong side of the mountain, and we should at last have emerged from the woods near a village fully twenty miles from our starting point.

Meanwhile, the weather, so fair in the morning, had changed; and it began to rain. There were four animals to be taken care of, we were four miles from shelter, and the way between was unbroken forest and mountain side, with a trail which was barely discernible by daylight. My companion and the guide each took a horse, I mounted my mule, and the other mule was turned loose to follow or lead as he saw fit. Just as darkness came on we began our march, my companion taking the lead, and Glass bringing up the rear. The rain, at first gentle, became violent; the darkness was intense; and still our animals carried us along faithfully over logs and stones, through thickets and across brooks, bearing us safely even in places where by daylight we had dismounted and led them. Every now and then my mule would stop and reconnoitre, and immediately

afterwards I could feel that he was cautiously stepping over an obstacle, or picking his way through some place of danger, it might be the stony bed of a stream. Once, my companion was brushed off of his horse by the limbs of a tree; but fortunately without serious injury or delay.

At length, about half way home, the animals stopped, and would not budge another step. My companion and myself were close together; but the guide was far in the rear, out of hearing, we knew not where. We were alone in a strange forest, two miles from the nearest house, in pitchy darkness and a drenching storm. Calling to each other, for seeing was out of the question, we managed to grope our way across the distance which separated us, and to clasp hands. Even then we could not see each other, the darkness was so intense. Nothing could be distinguished, save that upon looking upward we could see the blacker treetops against the less black sky; while below, the ghastly glimmer of an occasional fox-fire indicated the resting place of some decaying log or tree. What was to be done? My companion advised our staying where we were until morning, or until relief came; but to this suggestion I would not listen. Under such a policy we might have been chilled through, and even worse results could have followed. We must press on, I urged, at all hazards, and try to get out of danger. I felt sure of the right direction, and knew that the exertion of moving about would protect us against cold. So we abandoned our animals and started. Step by step, keeping close together, we groped through the darkness, with painful slowness and caution. Every now and then we ran into a tree, or brought up sharply against some breast-high log, over which we had to clamber. Once we found ourselves in a thicket of rhododendrons. Any one who has been in such a thicket in the daytime will appreciate the beauty of this situation. Here, to satisfy my companion, I crept underneath a huge fallen tree away from the rain, lighted a match, and consulted my compass, to make sure we were not going astray. Through the thicket we forced our way, and again moved on with intolerable tediousness. Every foot of the ground was strange to us, and we could see absolutely nothing except when an occasional

flash of lightning briefly illumined the forest. At last we came to a large brook, and, crossing it, found ourselves at the end of the road upon which our route in the morning began. The rain now ceased, the moon came out, and at eleven o'clock we reached the house, drenched, exhausted, and famished. The other division of our party got safely in just at dark, and they were about sending out men with horns and torches to hunt us up. So we sent them to find the guide, and at half past twelve they brought him in, and with him the more intelligent animals.

Tired as we were we scarcely slept that night. Morning was welcome; and at the earliest hour possible we started on our return, glad to get away from the dirt and the diet of William Glass's log cabin. Early in the afternoon we got back to Asheville and civilization; and thus ended a series of adventures mnch pleasanter to look back upon than to endure.

From Asheville a regular daily stage or wagon runs to Warm Springs; a famous watering place near the Tennessee border. The distance is about thirty-six miles; and the gully, full of boulders, which serves for a road follows down the valley of the French Broad River, much of the way almost at the water's edge. The river is large and rapid, falling over nine hundred feet between Asheville and Warm Springs, and thus furnishing an enormous and inexhaustible water-power which awaits development. At places the mountains rise almost directly from the waterside, and at Mountain Island, where the river has cut its way directly through a lofty range, the scenery is indescribably fine. Near Warm Springs, stratified rocks take the place of the metamorphic formations which characterize the higher mountain region; and occasionally they form picturesque cliffs which literally overhang the road. Such another example is Paint Rock, about six miles below. The latter locality, deriving its name from some curious Indian hieroglyphics which are daubed upon the face of the precipice about thirty feet from the ground, is especially interesting. Here there is just room for the road between the cliff and the river; and the former actually overhangs your carriage as you drive by. The rock is a high, narrow, wedge-shaped mass which has been left in its

isolated position by the eroding action of the streams around it. On the cliff side it presents a rocky wall about one hundred feet in height, and on the other it slopes steeply up to a narrow ridge at the summit. From the top a lovely view of river, islands, and mountain is easily gained.

At Warm Springs I bade farewell to North Carolina. Eight miles of staging took me to Wolf Creek Station in Tennessee; whence it was forty miles by rail to Morristown. Then a day longer saw me at Chattanooga, and another day was spent on beautiful Lookout Mountain; a summit well worthy the attention of "Appalachians." Then home to Cincinnati by way of Nashville, the Mammoth Cave, and Louisville; and thus ended a summer's journey, upon which I shall ever look back with satisfaction.

The Benton Range and Mount Moosilauke.

By Rev. Henry G. Spaulding.

Read October 9, 1878.

The introductory chapter of King's "White Hills" treats of the "Four Valleys of the mountain region" — the four avenues which lead to the Mt. Washington and Franconia Ranges. Along these paths of approach are found the noblest views of mountain scenery; while the valleys themselves and the "little hills" are everywhere vocal with beauty. Of this Valley-Quartette — the Androscoggin, the Saco, the Pemigewasset and the Connecticut, the last named is the rich-toned soprano, taking the leading part in the varied music of the hills.

Referring the reader to the eloquent pages of our New England Ruskin for descriptions of the better known sections of the Connecticut Valley, I would pay a passing tribute to the exceeding loveliness of a part of this valley which is less frequented — the rich fringe of meadow-land bordering the lowest slopes of the Franconia Range and lying between Haverhill, N. H., and Newbury, Vt.

The largest of this chain of intervales is the "Great Oxbow," between Newbury and North Haverhill,— a broad expanse of

fertile land around which the river sweeps in a long and graceful curve, almost making an island. We recall the *Campus Martius* of old Rome, formed by the windings of the Tiber; only the peaceful name of our intervale suggests the contrast in the uses of the two widely-remote peninsulas. And certainly not even the monuments of the Eternal City, its classic temples and Christian churches now covering the ancient "Field of Mars," can give such pleasure as the emerald green of these far-stretching fields of grass and corn, set off by the wavy masses of golden grain, and the sombre pines by the river's edge. There may be lovelier pictures of cultivated landscape than this, but, for one, I know not where they can be found. This satisfies. It is wanting in no element of beautiful scenery. It is a perfect symphony of color, a brilliant mosaic of land and water. "The little hills rejoice on every side; the pastures are clothed with flocks; the valleys also are covered with corn; they shout for joy; they also sing."

The hills which greet us from point to point as we drive through these intervales not only charm us by their individual characteristics, but they also enter into varied combinations with each other, like so many rich themes in a sonata. Looking east from Haverhill (or, better still, from the slopes of the Vermont hills across the river), you trace the long and picturesque "Benton Range." That low point to the south, just under the shadow of Moosilauke, is Owl's Head. As you see it from the road to Warren, which passes beneath its steep, bare cliffs, you are at no loss to explain its name. It is the gigantic skeleton of the head of an owl,—a wonderful section of crumpled slate rock. Next to Owl's Head on the north is Blueberry Mountain, two thousand eight hundred feet high, abounding in those luscious berries, which grow the sweetest on such granite ledges, where they receive the reflected as well as the direct rays of the August sun. Then comes, still to the north, the unmistakable Sugar Loaf (happy proximity of sugar and berries!), looking like a baby Alp. Yet let no ambitious mountain-climber deceive himself. This is a very Hercules in its defiant strength, and in the persistent opposition it will make to the daring adventurer who attempts to scale its summit.

North of Sugar Loaf is Black Mountain, a noble peak that waits for a nobler and more appropriate name. This is the dominant note in all the music of these hills. Looked at from any point in the valley, it looms up like Chocorua, in bold and rugged independence. I have seldom seen so fascinating a hill. It draws your gaze whether you will look or not. It watches you like the eyes of a portrait. In its unblushing self-assertion it is a downright pagan. But its pride justifies itself; and the better you know this princely peak, the more will you love it. "Out of the strong cometh forth sweetness"; and the strength of Black Mountain provokes only gentle thoughts and peaceful musings. There are no false notes in Nature's harmonies of form and color. Struck on the key-board of this granite-stringed region, Black Mountain is tuneful with the fresh thought of the Great Composer. Let us listen and rejoice.

The drive from Haverhill to the base of Moosilauke affords many fine views of the picturesque Benton Mountains. Their several peaks play at hide-and-go-seek as the road winds along the banks of the roaring Oliverian. This stream, whose waters make a musical accompaniment to our drive, marks the course of one of the four great mountain notches of Northern New Hampshire, a "pass" from the eastern to the western regions of the State. The scenery has neither the varied wildness of the Pinkham Notch, with its famous cascades, nor the solemn grandeur of the White Mountain Notch, nor yet the tranquil beauty of the Franconia Notch. But the true lover of Nature will enjoy a treat both rich and rare in this pleasant brook-road with its changing vistas of the nearer hills, and its fringes of elm-sprinkled meadows or beetling crags. At the little village of East Haverhill a bit of Moosilauke appears just over the southern spur of the Benton range, looking like a halo of empurpled radiance crowning the lesser hills.

Beyond the dark-hued precipice of Owl's Head the road winds through a pleasant wood, and then, just at the edge of Warren Village, makes a sharp turn to the north-east, into the valley of Baker's River. Asquamchúmauke is the mouth-filling Indian name of this turbulent stream, whose headquarters are far up on the side of Moosilauke. Let us talk a

moment about this nomenclature, as we follow up the river and ascend the steep slope of the great mountain before us. That syllable, *auke*, which terminates the names of both river and mountain, means *place*. *Moosi*, is Indian for *bald*. So speaking in the dialect of the aborigines, we may say that many a man of our acquaintance has a Moosilauke on his head! The baldness of the mountain, however, is confined to its summit, and the appropriateness of the Indian name only appears when one walks over the sickle-shaped ridge between the south and north peaks, and climbs the sharp cone of rock which marks the highest point. But to return to our philology. Asquamchúmauke, whose amber waters break into white ruffles as they chatter over the stones, is a truly Homeric compound. Water-from-the-mountain-place is the English of the word,—a home-spun name sufficiently realistic to satisfy the sharpest critic of the ideal, yet having, for some unexplained reason, an almost poetic charm. The syllable which signifies mountain is an altered form of *wadchu*, which enters also into the composition of such familiar names as Wachusett (near-the-mountain), and Massachusetts (near-the-great-mountain). This comparative study of Indian names occupies our minds until, at the base of of the mountain, we reach N. Merrill's farm and boarding-house, with picturesque surroundings of barns and bee-hives, orchards, grain-fields, and pastures. From this view-point one sees the wooded crests of the Warren Hills, Mounts Carr, Kinneo, Cushman, and Waternomee sweeping round in a half circle from the south-west; while, to the north the massive Moosilauke looms up like a double-headed Titan. Passing through the toll-gate by the farm-house ("Mary's Gate," the sign-board has it), we follow up the hillside pasture by the great orchard of sugar-maples, and soon enter the deep woods. Just before crossing "Big Brook," we catch a glimpse of the southern horn of the mountain set in a frame of spreading birches.

Beguiling the long ascent by occasional halts and perpetual puns, not unobservant of the plants and flowers by the road-side, we reach at length the "mountain's summit, dark and high." This is the sentinel peak of the White Mountain re-

gion. As Starr King said of Mt. Hayes, in Gorham, that it is "the chair set by the Creator at the proper distance and angle to appreciate and enjoy Mt. Washington's kingly prominence," so may we say of Moosilauke that it is the natural view-point from which to see the united grace and sublimity of our New England Switzerland. What I once wrote of the view from Mt. Chocorua (embodied in Mr. King's eloquent description of that rugged peak) may be repeated here: "On one side. . . . a charming lowland prospect indented by the emerald shores of Lake Winnipiseogee" (for the lake we must here substitute the silvery thread of the Connecticut). "Pass to the other side of the steep pyramid, and you have turned to another page in the book of Nature. Nothing is visible but mountains running in long parallels, or bending ridge on ridge, here blazing in sunlight, there gloomy with shadows."

This Moosilauke view is an enlarged picture of the Chocorua prospect, with added lines and heightened colors. There is the same terrestial ocean of forests, billowed by innumerable peaks and ridges that you gaze upon from the top of Mt. Washington. But the chaos here yields to kosmos. The confused mass of the huddling ranges gives way to a more orderly disposition; and as the eye goes from one parallel to another the separate heights become plainly distinguishable. This study of the mountain topography, in the prospect which spreads before you on the north and east of Moosilauke, is the first step toward a true enjoyment of the scene. Not that names are needed to give that uplifting of soul above earth's meaner things which comes from mountain scenery. But the secret of the mountains' influence over us lies in their *suggestiveness*, and the process of naming their separate ranges and summits gives them an increase of power in this direction. If we have known the individual heights before, their names awaken pleasing associations, and we use them with the same delight with which we speak the familiar names of our friends. Let us stand here, then, for a while under the lee of the Prospect House, a little way down the eastern slope of this rocky summit, and with the aid of the signal service chart, and the help of the exhaustive description in Osgood's "White Mountain

Guide Book," trace these serrated ridges, with their domes and pyramids, from north to south. I spare the reader the information which he can so easily obtain from the guide book; but I cannot omit the advice to make a careful study of this guide-book description on the spot where the great pictures are hung before him. To some observers the other page in this wonderful chapter of natural scenery will doubtless be more attractive,—the leaf on which is written the *idyl of the Connecticut*. This is not, as we might imagine, a lowland-valley view, so completely do the broad intervales through which the river runs blend with the spreading uplands on either side. These vast spaces to the west are also bounded and dotted by noble mountain forms, in both the near and far distances,—the long and flattened curve of Monadnock, Ascutney's pointed crest, the blue top of far-away Mt. Marcy, in New York, and the glorious Green Mountain range, with its stately peaks of Mansfield and Camel's Hump, besides many an unnamed lesser height which adds its note to swell the full-voiced harmony. A landscape like this may be as suggestive of the eternal forces which have shaped our earth, and lead on the mind to thoughts of infinity, as well as mountain grandeur and the awful sublimity of rock-clad summits. "He that hath ears to hear, let him hear" what these differently toned orchestras give forth of the divine music.

Smiling vales and frowning hills, "stern diadem of rocks" and "mantle of rich cultivation," let them each impart to us their gift of beauty, which remembrance shall transmute into "a joy forever." Here on Moosilauke, watching the broad shadows and soft lights which the clouds are throwing on mountain and valley, seeing how shapely is this architecture of the hills, each part fitted to the whole as column and cornice in the Parthenon, one feels as nowhere else the union in the modern mind of the romantic and the classical tastes. These enameled vales of the cultivated landscape below us would have pleased old "Lauriger Horatius" as truly as they give us delight, while Rousseau would have gazed with the same deep emotion on these tumultuous waves of mountain ridges. Or shall I take a hint from Matthew Arnold, and say that *Hebra-*

ism and *Hellenism* here claim us as the rightful heirs of both civilizations? These mountains stand as of old they stood, when prophet and psalmist unfolded their teachings, the symbols of the Infinite One who established their foundations, and on their "roaring loom" is forever weaving his living robes. And in these swelling uplands and winding valleys, so eloquent of the skill and industry of human generations, we see the glorious achievements of man, — the "sweetness and light" of human culture.

The Identification of Distant Points.

By J. Rayner Edmands.

Read February 12, 1879.

One of the results of bringing together in the Club a number of those who had previously visited the mountains without the benefit of such association, has been to show that the ability to name with accuracy the various objects seen from an eminence depends as much upon general practice in identifying, as upon familiarity with the summit in question.

Our first concern is to locate the salient features of the landscape (see A); next we look to less conspicuous objects; and finally we decide the more difficult distant points. Three things are to be noted: — direction, elevation and profile (B). Or, we might say six, for in each case what is seen must be compared with what is derived from knowledge of the country, as shown on a map, given in a table of figures, or acquired by personal exploration of the region (C). Other facts often come to our aid. The visibility of characteristic objects known to exist on a particular mountain, such as a building, a land-slide, or an isolated group of trees or boulders, may be mentioned as an example. Alignment, a close approximation of the directions in which two summits are seen, is a great help, coming to our aid oftener than might be imagined to decide a question of direction without any measurement (D). Calculating in advance the angular elevation of points, for which search is to be made, may prevent much subsequent waste of time, by proving that some of them cannot show above the intervening country (E).

The writer has devised simplified methods for calculating the sight-line between two points, for plotting upon a map whose borders need not include the points in question (G). We may thus ascertain just what hills intervene, in order to make the vertical comparison with greater refinement.

But the work of identification is not complete until some of the processes have been reversed. We may select undiscovered points and predicate where and how they must be seen, if seen at all (F and H). With the topographical camera we may make an accurate drawing of what is easily seen in a given direction, and upon this may be marked the calculated position and outline of the as yet undiscovered summit. And so we either confidently predict its discovery, or assert that nothing but extraordinary refraction can bring it into view.

Thus the whole matter of identification is taken from the sphere of conjecture. But it should be borne in mind that all these refinements are not always necessary, and that it is practice alone which will show how far to go in any case in order to be sure.

A. Initial identification in an unfamiliar region.

Upon a map of the region place a disc of paper, ten to twenty centimeters in diameter (4 to 8 inches), with its centre fixed by a pin driven through the point to be visited. Rule the meridian, and also lines radiating from the pin toward surrounding summits. Write names upon the lines corresponding to objects likely to be conspicuous in the view, and upon the other lines place numbers referring to an index of names. Arrived on the spot, hold the paper horizontal, orient it roughly by comparing the meridian with compass or sun, and identify the prominent forms. Then fold the paper along a diameter nearly at right angles to the direction to be studied, and insert pins near the circumference upon a few lines corresponding to points already known. Then place the eye near the centre, and turn the semicircle till the pins lie in the directions of the corresponding points. Other points may now be compared with other lines by merely turning the eye.

B. Noting the facts.

Aim to accumulate as much material as possible for study on reaching home. Nothing is so satisfactory as actual measurement. The accuracy of the theodolite is not needed in horizontal measures for this purpose, the camera, the micrometer-level, the radiating plane-table, the prismatic

compass, or the pocket-sextant being all that is required. Accuracy of vertical measurement is most easily obtained with the micrometer-level, but a majority of the points can be settled without the vertical angles. The topographical camera gives the most complete set of results. The radiating plane-table has the advantage of giving horizontal angles directly comparable with the map, without the intermediate work of plotting or protracting. Angular measures should be supplemented with eye-sketches of the profile. For an example of the use of the camera in identifying, see Appalachia, Vol. I, page 269. To the recommendations there made it may be added, that a few vertical readings with the micrometer-level are especially valuable in locating the horizon upon the camera profiles.

C. Knowledge of the region.

Besides the sheet of radiating lines mentioned in the first note, one should have whatever maps and profiles can be obtained. Profiles of a mountain, whether by eye or instrument, taken from a nearer point in the same general direction, are a great assistance. The flat outline of Katahdin, as seen from points near Moosehead Lake, early raised the doubt whether Katahdin was seen from Mt. Washington "driven like a wedge in the sky." But profiles taken in nearly the opposite direction are serviceable. The Sandwich range hides Mt. Washington from the view at Wachusett. Any doubt on this point is quickly settled by comparing a sketch of what *is* seen at Wachusett, with the profile of Whiteface and Passaconnaway, as seen at Washington.

D. Alignments.

We are indebted to Prof. E. C. Pickering for suggesting the importance of these. They may be discovered in advance by stretching a thread upon the map, and seeking pairs of points which shall lie nearly in line with the point occupied. Examples: Mt. Wachusett, Joe English Hill, and Gunstock (Mt. Belknap); Wachusett, Kearsarge (South), and Moosilauke; Mt. Field, Mt. Starr King, and the Percy Peaks.

E. Comparison of vertical angles with known relations of elevation and distance.

This comparison has been used by Mr. W. H. Pickering (Appalachia, Vol. 1, pages 86 and 168.) Tables for the effect of curvature and refraction upon the apparent elevation of points at various distances are given in several treatises, and are often very convenient. But it is sufficient to remember that the effect in meters is one-fifteenth of the square of the distance in kilometers: *i. e.*, if there were no curvature nor refraction, a point thirty kilometers distant would appear as high as a point sixty meters higher (and at the same distance) does appear under the ordinary conditions.

For calculating the elevation of any point on the line of sight when the vertical angle is known, the ordinary formula for elevation will serve.

Let H_0 and H_1 be respectively the elevations of two fixed points,

K the distance between them,

t_0 the tangent of the inclination of the line of sight (actual or imagined), at the point whose elevation is H_0.

For any point in line with the fixed points let k_0 and k_1 be respectively the distances from the points whose elevations are H_0 and H_1; and h the elevation of the sight-line passing through the fixed points.

Then for distances and elevations in meters

$$h = H_0 + t_0 k_0 + \frac{2}{30}\left(\frac{k_0}{1{,}000}\right)^2 \qquad (1).$$

For great distances, however, this is only approximate, on account of the uncertainty as to the amount of refraction actually existing at the time.

When t_0 has not been observed, it may be calculated (approximately), if H_1 and K are known. For making $h = H_1$ and $k_0 = K$ in (1), and transposing, we obtain, $t_0 = \dfrac{H_1 - H_0}{K} - \dfrac{2\,K}{30\,000\,000}$ (2).

Or, better, the desired elevation may be calculated directly. Substituting (2) in (1), combining terms, and remembering that $K = k_0 + k_1$, we have

$$h = H_0 + (H_1 - H_0)\,\frac{k_0}{K} - \frac{2}{30}\cdot\frac{k_0}{1000}\cdot\frac{k_1}{1000} \qquad (3).$$

The first two terms of the right hand member of (3) give the height which a point on the line of sight would have, were there no curvature nor refraction. From the third term we obtain the following statement. The effect, in meters, of curvature and refraction, in diminishing the elevation of the sight-line at any point between two others, equals one-fifteenth of the product of the lengths, in kilometers, of the two segments into which the first-mentioned point divides the distance between the other two. For example, if two summits are 100 km. apart, the effect of curvature and refraction at a point distant 30 km. from either end amounts to a diminution of $\dfrac{30 \times 70}{15} = 140$ meters in the elevation of the sight-line at the intermediate point.

In regard to the accuracy of the above formulæ it may be said that, excluding instances of unusual refraction, the uncertainty will lie in the third significant figure of the term involving the effect of refraction. And in comparing the elevation of the sight-line with that of the country, a wide margin must be allowed for abnormal increase in the refraction : *i. e.*, visibility may be predicted with greater accuracy than invisibility.

F. Calculating the azimuth from the latitude and longitude.[1]

Let L and M be respectively the latitude and longitude of the occupied point,

L′ and M′ the latitude and longitude of another point,

Z, the azimuth of the line from L, M, to L′, M′, measured from south around by west.

Let $e^2 = 0.006674$, a figure depending upon the eccentricity of the earth, $\log e^2 = 7.8244$, and $\log\left(\frac{\sin 1''}{2}\right) = 4.384545$

The established formula may be put in the form

$$\cot Z = \frac{L - L'}{pq} - p \tan L \frac{\sin 1''}{2} \quad (4), \quad \text{where}$$

$$p = (M' - M) \cot L' \quad (5), \quad \text{and} \quad q = 1 + e^2\cos^2 L \quad (6).$$

Values of log q will be found tabulated below.

But since the second term of the right-hand member of (4) is small, we may further simplify. If Δ be any small angle we have

$$\cot (z + \Delta) = \cot z - \frac{\sin 1''}{\sin^2 z}\Delta \quad (7), \quad \text{nearly, whence letting}$$

$$Z = z + \Delta \quad (8), \quad \text{and} \quad \tan z = \frac{pq}{L - L'} \quad (9), \quad \text{we have the last}$$

term of (7) equal to the last term of (4). Equating, etc., then gives

$$\Delta = \frac{p \tan L \sin^2 z}{2} \quad (10).$$

L — L′, M′ — M, and Δ are in seconds.

VALUES OF LOG q.

Latitude	Log q	Latitude	Log q
39° 57′	0.00170	45° 56′	0.00140
41° 57′	0.00160	47° 55′	0.00130
43° 57′	0.00150	49° 55′	0.00120

To calculate, first use (5) and (9), and look out sin z at the same time with z. Then use (10) and finally (8). Carefully regard signs. For extremely long visual lines the result will be reliable to minutes, which is all that is required for purposes of identification. For calculating the direction of the line joining two stations of a triangulation, the result may be depended upon to five or ten seconds in any case likely to occur, the error being proportional to the square of the distance, and for any given distance being a maximum about 65° from the meridian. For greater refinement, however, it will be better to return to equation (4).

G. To interpolate points on the line of sight between two others.[2]

The successive calculation of azumuth, latitude, and longitude being slow the latitude especially requiring extensive tables, we resort to the device of

[1] See Example 1. [2] See Example 2.

assuming the value of a certain coëfficient (according to the vicinity in which the point is to lie), and calculating the latitude and the longitude of the point on the line for which this value holds. In addition to the notation already used, let L″ and M″ be respectively the latitude and longitude of the new point. Substituting (5) in (4), writing a similar equation with L′ and M′ replaced by L″ and M″, equating right-hand members, multiplying through by q (M″ — M) cos L″, transposing and placing

$\frac{(M' - M) \cos L'}{(M'' - M) \cos L''} = c$ (11), and $(M'' - M) \cos L'' = s$ (12), we have

$$L'' - L = \frac{L' - L}{c} + (c - 1)\, s^2 .\, q \frac{\sin 1''}{2} \tan L \quad (13),$$

and $M'' - M = \frac{s}{\cos L''}$ (14), where from (11) and (12)

$$s = \frac{(M' - M) \cos L'}{c} \quad (15).$$

To calculate, we assume a convenient value for c, noticing from (11) that it roughly represents the ratio of the distances of the other two points from the one whose latitude is L, and with this value we solve (15). Then we are in possession of all that is required for solving (13) and (14). Other points may then be calculated by assuming new values for c.

To plot one of these points on a map reduces to obtaining the distances on its scale from the nearest parallel and meridian, corresponding to the excess of the latitude and longitude of the point above those of the parallel and meridian. There are tables for this purpose, but it is best done by a simple graphical construction. On a separate piece of paper and on any scale lay off A C equal to the number of seconds between two consecutive parallels or meridians on the map, and C D the actual distance transferred from the map, between the particular pair of lines between which the point to be plotted is to lie. On the line A C take AB equal to the number of seconds whose length on the map is desired. Draw B F parallel to C D, and draw A D intersecting B F in E. Then is B E the length desired for direct transfer to the map. Make a separate construction for latitude and for longitude.

D.
F.
E.
A. B. C.

Formula (3) for the elevation of an interpolated point involves the ratio of distance $k_0 \div K$. For lines running more nearly east and west than north and south, that is, when the difference between L′ and L is not large, we may take this equal to $1 \div c$ nearly. For lines running more nearly north and south than east and west, that is, when the difference between M and M′ is not large, we may take $k_0 \div K = (L'' - L), \div (L' - L)$, nearly But in order to allow for the curvature and refraction we also need the

length of the two segments k_0 and k_1. If the two intervisible points have been plotted upon a map, it will be sufficient to obtain an approximate value of K from measurement, to calulate $k_0 \div K$ as above, and then to take

$$\frac{2}{30}\ \frac{k_0}{1000}\ \frac{k_1}{1000} = \frac{2}{30}\ \frac{k_0}{K}\left(1-\frac{k_0}{K}\right)\left(\frac{K}{1000}\right)^2 \qquad (16)$$

When the points have not been plotted we must calculate the distance. We have $K = \frac{p\,N \sin 1''}{\sin Z}$ (17), where N is the radius of curvature of a section of the earth perpendicular to the meridian. Using z instead of Z, we then have $K^2 = p^2\,(N \sin 1'')^2 + (L - L')^2 \left(\frac{N \sin 1''}{q}\right)^2$ (18) nearly, where for the latitude of New England, $\log\,(N \sin 1'')^2 = 2.982$, and $\log \left(\frac{N \sin 1''}{q}\right)^2 = 2.978$, in the southern, to 2.980 in the extreme northern portion.

This formula in effect finds the linear distances upon the parallel and the meridian, and then finds the hypothenuse by the Pythagorean proposition, a process near enough to truth for our purpose. Somewhat greater accuracy would be had by using the cosine of the mean latitude instead of cos L′ in the value of P, but when such is desired it will be better to use (17) with the true numerical value of sin Z.

The foregoing belong to a class of problems calling for the methods of geodesy, without the extreme accuracy usually aimed at. Material for similar treatment is accessible in the reports of the Coast Survey and in No. 12 of the Professional Papers of the Corps of Engineers, U. S. A.

H. To construct the outline of a distant mountain.

To do this requires a contour map of the distant mountain, which need not include the point occupied. The method given is not applicable, without modification, to a near mountain seen from a point of very different elevation.

To prepare for the work, make a set of constructions upon slips of tracing-paper. Midway the width of the slip is drawn a longitudinal line, carrying a scale of millimeters whose zero point is far beyond the limit of the slip. Let *A* be some round number of millimeters corresponding to a point on the scale near one end of the slip. Through that point draw a line perpendicular to the longitudinal line, and upon this transverse line lay off a scale whose unit is *A* millimeters, making the subdivisions as fine as convenient, or as experience with the method shall have led one to prefer. Proceed similarly for a point near the other end of the slip. Join corresponding points on the two transverse scales, thus getting a system of lines converging toward the zero of the longitudinal scale. By heavier lines at proper intervals make it easy to read either the transverse or the longi-

tudinal scale without mistake of decimal point or other error, the transverse scale reading + and — from the longitudinal line. Also for plotting the profile procure rectangular paper, whose unit is the same for both coördinates, although the horizontal distances need not be finely subdivided. To prepare the map, draw upon it, in the vicinity of the distant mountain, a line pointing toward the occupied point. If the occupied point lies off the map assume one point near the distant mountain, and interpolate another on the line by methods already given. On this line mark any point, of which is known its distance to the occupied point in millimeters upon a map of that scale. Also make, for use in connection with maps of the particular scale, a small right triangle, upon one leg of which is a scale of meters reduced to the scale of the map, the zero of the scale coinciding with the undivided edge. To complete the preparations calculate the allowance for curvature and refraction, by dividing the approximate distance, in kilometers, from the occupied point to the mountain, by fifteen times the number of millimeters on the map, required to represent one kilometer. But do not confound this with the allowance as ordinarily used for other purposes.

Place the slip of tracing paper upon the map, with its longitudinal line upon the sight-line drawn on the map, and move it longitudinally till the point of known distance has a corresponding reading upon the scale of millimeters. Then were both map and slip extended, the zero of the scale would lie upon the occupied point. But each point of tangency between a contour of the map and a radiating line of the tracing, or between a contour and any radiating line of the same system which the eye may imagine, will be a point on the profile seen at the point from which the radiating lines diverge. Selecting then an origin of abcissas on the rectangular paper, corresponding to the line drawn upon the map, we can read, upon the scale of radiating lines on the tracing, the abcissas of points on the profile, corresponding to the various contours of the map.

It remains to plot the corresponding ordinates. From the elevation of the contour subtract the elevation of the occupied point, expressing the difference in meters. Place the card triangle with its plain edge against the longitudinal line on the tracing, and its divided edge cutting the point of tangency of the contour ; select the reading upon its scale, corresponding to the number of meters difference in elevation ; and note the corresponding reading of the scale of radiating lines. The last is a mere graphical device for dividing the number of meters difference in height, as it would appear upon the particular scale of the map, by the number of millimeters of distance upon the map. From the result subtract the allowance for curvature and refraction as found above, and the difference is the ordinate desired.

We thus plot tangents of horizontal and vertical angles, referred to a radius of as many units of the rectangular paper, as the number of meters which one millimeter on the map would represent on the surface of the country. And as the radius, corresponding to a scale of one unit to the

degree, is $180° \div \pi = 57.3$ units, the scale may readily be found. There is no exaggeration of the vertical.

When several mountains at different distances lie in nearly the same direction, interpolate pairs of points near each mountain but upon a single sight-line; make this the origin of abcissas; and thus combine several mountains in one profile, showing each in its true relation to the others.

EXAMPLE 1.—Azimuth.

	Latitude.	*Longitude.*
Mt. Washington	44° 16′ 13″	71° 18′ 13″
[to] Mt. Katahdin	45° 53′ 40″	68° 54′ 51″

$L - L' = -1° 37' 27'' = -5847''$ $\qquad$ $M' - M = -2° 23' 22'' = -8602''$

log (M′ − M)	3.9346	log p	3.777
log cos L′	9.8426	log tan L	9.989
[log p]	3.7772	log sin²z	9.711
log q	0.0015	log ½	9.699
[log pq]	3.7787	[log Δ]	3.176
log (L — L′)	3.7669	z (180°+)	45° 46′ 40″
[log tan z]	0.0118	Δ +1500″	25′ 00″
[log sin z]	9.8553	Z =	226° 11′ 40″

Formula (4) gives Z = 226° 12′ 00″, showing that in this case formula (7) involves an error of about 20″.

EXAMPLE 2.

Points in line with Mts. Washington and Katahdin.

Values of L, M, L′ and M′ as in preceding example.

LATITUDES.

Assume c = 1.6

		log q	0.001	L		44° 16′ 13″
log (M′ — M)	3.9346	log (½ sin 1″)	4.385	(L′—L)/c	+3654.3″	
log cos L′	9.8426	log tan L	9.989			
	3.7772		4.375		+ 19.9″	
log c	0.2041	log s²	7.146			
[log s]	3.5731	log (c — 1)	9.778	L″—L	+3674.″	= 1° 01′ 14″
		[+19.9″]	1.299	L″=		45° 17′ 27″

Assume c = 2

(Brought down)	3.7772	(Brought down)	4.375	L		44° 16′ 13″
log c	0.3010	log s²	6.952	(L′—L)/c	+2923.5″	
[log s]	3.4762	log (c — 1)	0.000			
		[+ 21.2″]	1.327		+ 21.2″	
					+2945.″	= 0° 49′ 05″
				L″=		45° 05′ 18″

Assume c = 2.5

(Brought down)	3.7772	(Brought down)	4.375	L		44° 16′ 13″
log c	0.3980	log s²	6.758	(L′—L)/c	+2338.8″	
[log s]	3.3792	log (c — 1)	0.176			
		[+ 20.4″]	1.309		+ 20.4″	
				L″—L	+2359.″	= 0° 39′ 19″
				L″=		44° 55′ 32″

Notice the uniformity in the value of the last term (19.9″, 21.2″ etc.,) whereby it is only necessary to calculate it by the formula for a few points, however many may be required. One second of latitude is about 30 meters (100 feet.)

LONGITUDES.

	$c = 1.6$		$c = 2.$		$c = 3.$	
log s	3.5731		3.4762		3.3792	
log cos L″	9.8473		9.8488		9.8501	
[log (M″—M)]	3.7258		3.6274		3.5291	
M		71° 18′ 13″		71° 18′ 13″		71° 18′ 13″
M″—M	—5319″ =	— 1° 28′ 39″	—4240″ =	— 1° 10′ 40″	—3381″ =	— 0° 56′ 21″
M″ =		69° 49′ 34″		70° 07′ 33″		70° 21′ 52″

DISTANCE.

log p	3.7772	log L—L′	3.7669	34400 000 000
[log p²]	7.554	[log (L—L′)²]	7.534	32600 000 000
log (N sin 1″)²	2.982	$\log \left(\frac{N \sin 1''}{q}\right)^2$	2.979	K² = 67000 000 000
	10.536		10.513	K = 259000 meters
				= 161 miles, nearly.

ELEVATIONS.

	$c = 1.6$			$c = 2.$			$c = 2.5$		
H_0 (2 m. added for ht. of eye)			1920			1920			1920
H_1	1600								
$[H_1—H_0]$	—320								
$\frac{k_0}{K}$	$\frac{5}{8}$			0.5			0.4		
For slope		—200			—160			—130	
$1 - \frac{k_0}{K}$	$\frac{3}{8}$			0.5			0.6		
$\left(\frac{K}{1000}\right)^2$	67 000								
For curv. and refr'n		—1050			—1120			—1070	
			1250			1280			—1200
h =			670			640			720

SUMMARY.

The following table summarizes these results, giving the latitude, longitude and height of three points in line between Washington and Katahdin, for comparison with the actual elevation of the land.

Latitude.	*Longitude.*	*Height.*[1]	
45° 17′ 27″	69° 49′ 34″	670 meters	2200 feet.
45° 05′ 18″	70° 07′ 33″	640 "	2100 "
44° 55′ 32″	70° 21′ 52″	720 "	2350 "

[1] Uncertainty due to refraction, in these cases, equals about 50 feet, exclusive of abnormal variations.

Camp Life for Ladies.

BY MISS M. F. WHITMAN.

Read July 10, 1878.

The Lexington Botanical Club, consisting of four ladies and two gentlemen, have for many years spent their summer vacations among the mountains. Long ago, when the only way to reach the mountains was by stage routes — glorious rides, for which we all scrambled for the top — we began to make our trips and became familiar with mountain hotel life and the roads and places usually visited by the tourists of that day.

There was then to us an indescribable charm in the undisturbed wildness of the region passed through, in the lonely grandeur of the summits and the delicious plash of the mountain streams. But as houses of entertainment multiplied, and the increased facilities for reaching the mountains poured people into these regions, very much of that charm was taken away. We loved the mountains, every rock and rill, every ravine and ridge, but we loved them as we first saw them, when little of fashion or sham penetrated so far, and we determined to try some plan by which we might reach less frequented places, continue to enjoy our mountain trips free from those who go only to say they have been, and can only tell you when they return, which hotel sets the best table or where the finest dresses are seen.

We had heard much of camping out, of the delights of whole weeks in the open air, of the never-failing appetite produced by the entire change of habit, and, most health-giving of all, the delicious sleep on fragrant hemlock, lulled by the murmur of mountain streams. Our elder brothers never failed to rouse to enthusiasm when camp-life was the topic of conversation, and it seemed to us that we, including the ladies even, might enjoy this life as well as they.

We made the attempt, first camping near Conway, that we might be within reach of protection should we chance to need it, and with very imperfect outfit. But this first attempt was so successful, and we so thoroughly enjoyed our vacation, without even stepping under a roof for three successive weeks, that

we have every year since shunned the hotels, and, to a great extent, the frequented places, and set up our housekeeping wherever we desired. We have sometimes travelled with our own horses, and pitched our tent wherever night found us, staying a few days in a place, or starting on after one night's halt, as the attractions of the region decided us.

At other times we have been conveyed far into the wilderness, and have trusted to fortune to get out again. And thus in one way or another we have camped throughout the White and Franconia Mountains, and beyond, through the Grafton Notch to Lake Umbagog, and through the Dixville range to the sources of the Connecticut.

I have thus hastily sketched the extent of our camping because this paper is chiefly for the benefit of women, and I desire to let them know that they may, if they will, do almost the same mountain work as men, may visit those delightful spots which have hitherto been but a name to them, may fish in streams sufficiently remote from civilization to contain trout more than two or three inches long, may enjoy views not down in the Guide Book even, and in this way may visit places usually regarded as inaccessible. To those fine ladies who care so little for seeing the real beauty of mountain or forest that a tear in their dresses or a shade of brown on their faces outweighs the gain of near and intimate acquaintance with nature in its grander phases, this paper will have little of interest. But to those who fear only from inexperience, it may give a few hints that will induce them to try camp-life for themselves.

Women who talk with us about camp, and who know nothing about it, seem to think it must be a life of hardship, and ask us if we are comfortable in a tent. They listen when we speak of a hemlock bed with a strange expression, half pity, half disgust. They ask: "What do you have to eat?" "How do you lay your table?" "Are you not afraid of insects?" "Are you much annoyed by bears?" and "Don't you take cold?"

A bed of hemlock with plenty of boughs properly laid, far excels the best Putnam or Saratoga spring. We can have to eat almost everything we wish. Taking cold is unknown in all

our camp-life. A thorough drenching, which would give one a severe cold or a twinge of rheumatism at home, seems to be harmless in our out-of-door life in flannels. As to insects and animals, I venture to say that more may be seen in any cultivated field in the same time than in any place we have ever camped. In a single tramp continuing two days from Pinkham Notch through Tuckerman's Ravine, the only animal seen was a toad, which did not appear to be very dangerous. Indeed our longing has seldom been gratified by finding even the track of a bear.

It is true that mosquitoes, black flies and midges are in some localities unpleasantly numerous, but the mosquitoes and flies are easily managed. A screen of netting around the walls of the tent and extending to the ground, with curtains of the same at the openings, will effectually keep them from the tent, and outside a smudge may be used if needed. Occasionally on a tramp, especially toward night in high altitudes, a veil confined at the shoulders with an elastic is required. As for the midges, or "mingens" as you will hear the natives call them, creatures that go through the finest netting, mind none but the densest smoke, and are too small to be easily seen, the less said about them the better. The only way to avoid them is not to go where they are. Don't go to the mountains until they are gone. They begin to disappear in July, and in August you avoid them altogether, and, to a great extent, the flies.

We hear very much of roughing it, and the term seems to be used to mean going without as many comforts as possible, as if a reasonable attention to the decencies of life were incompatible with real enjoyment of nature in her wilder forms. For a trip to last two or three days, when light luggage only can be taken, one can do very well with a towel and a comb, hard tack and oat-meal, and a simple shelter of canvas or bark. But for the usual camp we believe in having as many conveniences as possible, even luxuries, if one can afford it. We fail to see why we may not have all the roughing it desirable together with many of the comforts of home. And yet that the camp luggage may be within bounds, it requires some experience to know what to take and what to leave. The question of dress

is, perhaps, first in order. Every woman should have two full suits, even to boots—for a thorough drenching is not infrequent in mountain tramping—and a generous supply of thick stockings. We have tried many materials for dresses, ranging from stout gingham to Scotch winsey and ladies' cloth, and have unanimously concluded that flannel is by far the best for comfort and convenience. It is cooler in the hottest part of the day, and warmer when the dampness of evening strikes a chill through other goods. It does not tear easily; if soiled, can be dipped in a brook, hung on a neighboring bush, and when dry will look as well as new. This should be made loose, with a short skirt about to the tops of the boots, with another longer if it is desired for wear in public conveyance. Boots should be a comfortable fit, and stout enough to stand wetting without losing shape. Gloves strong and loose, and the hat wide enough to shade, and so trimmed as not to require constant attention. Rubber boots and a waterproof are necessities for use in the dampness of morning and evening, as well as in stormy weather. To answer more fully the question more frequently asked than any other, "What do you have to eat?" it is difficult in these regions to get beyond the reach of fresh eggs and milk. One can grow fat on oat-meal and baked potatoes. But who would not be satisfied with a breakfast like this,—coffee, for everybody drinks coffee in camp; oat-meal mush, with icy cold cream; potatoes baked to a turn and taken directly from the ashes to your plate, or fried, crisp and thin, rivalling even Revere chips; brook trout, caught an hour before, or breakfast bacon in thin crisp slices, just a delicate shade of brown, with fresh eggs in any style; golden Johnny cake smoking from the oven, followed by rice fritters served with bread, sweet butter and maple syrup. A breakfast like this discussed in the midst of grand old mountains is not to be compared with those served in a long bare dining-room, with rows of tables and crowds of people, and yet this is only a sample of breakfasts usually had in camp. And when a rainy day comes which permits no excursion—what elaborations of cooking are indulged in! What fun we used to have in our earlier camping in baking beans and boiling apple puddings under an umbrella rigged over the fire. Now

we have a luxurious kitchen with a shelter over the whole, and often a rustic table and other conveniences, so that even washing dishes becomes almost a luxury. It is unnecessary to go into further details, for in these days of prepared fruits, meats and vegetables it is not difficult to have supplies of almost everything desired, even in the wilderness.

The limits of this paper will not admit of a detailed description of camp furniture, or of camp work. In the latter we all do our part, even in the selection of a place for a camp and pitching the tent. It frequently becomes necessary to pitch camp in haste, so that it is important that each one should have a particular part to do. With a little experience women can do all this work without difficulty, and easily arrange many conveniences in and around the tent. We have done very much toward the construction of the one we now use, and have made it a perfect protection and very comfortable. It has walls higher than they are usually made, with a fly extending the length of the tent in front, and a hood reaching far down over the back—the latter being a great protection both from sun and rain. A generous supply of warm blankets should be taken, and the hemlock bed should be made with care. Place rubber blankets on the ground, and lay the boughs evenly, the larger at the bottom, and smaller ones above, lapping the tips of each row over the stems of the one previously laid. Put the woollen blankets next, and with a pillow made of smaller boughs, or a flannel dress not in use slipped smoothly into a cambric bag—the bed is complete.

So many are familiar with Mr. Warner's vivid description of the first night in camp, that I will say nothing further than that there is usually considerable growling, many poor jokes, and very little sleep. But as the novelty of this life wears off, the real luxury of sleep begins—a luxury of rest and comfort, the senses soothed with the aroma of hemlock, and lulled by the rippling of a mountain stream—a sleep that brings strength for the hardest climbs, and better fits us for serious work when vacation is over.

Appalachian Signals.

In view of the frequent need of communicating with persons beyond the reach of ordinary speech, the following system of signals has been adopted by the Appalachian Mountain Club.

SHORT CODE.

Signal.	*Key.*[1]	*Signal.*[2]	*Key.*
•	? (What)	• —	**The Call** ("Appalachia")
• •	**No**	• — •	**The Response** ("Appalachia," ?)
• • •	**Yes**	• — • —	**Good-bye**
• • • •	**Help**		

• • • • • (No, yes, *i.e.*) **Do not know**

[1] Dots under words in the key indicate correspondence between the number of letters in the word and dots in the signal.

[2] Two dots in quick succession may be used instead of the dash, *e. g.* • •• instead of • — for the call.

The dot stands for any simple sound, such as a shout, a whistle, or a pistol-shot; the dash for a prolongation of the sound. The flash of a mirror in sunlight, of a lantern, or its equivalent, may be used instead of sound. Motion up and down also may denote a dot; right and left a dash. A handkerchief, tied to a stick, may be the object moved.

Avoid anything which might be taken as a call for **help** *unless in need of it.*

This code furnishes a means of summoning aid from a distance, of answering many questions which may be asked by a person having a powerful voice under conditions which would render the words of a reply undistinguishable, and of communicating information to others of the party. For the last purpose it is only necessary to agree, before separating, upon certain implied questions, which the signals shall answer.

It is hoped that the short code will be widely acquired, and that the help call will be recognized as such by all who frequent our mountains and woods.

EXTENDED CODE.

Each message must consist of three members. The first two express an idea ; the third places it either in the interrogative, the negative or the affirmative. By negative is here meant a direct statement of the opposite.

COMBINATIONS INDICATING MOTION.

Signal.	*1st Member.*	*2d Member.*	*3d Member.*
•		R[1]	?[5]
• • (or —)	We (or I) go	on[2]	no
• • •	You go	off[3]	yes
• • • • (or — —)		away[4]	

[1] To the *right* of the speaker as he faces the listener; negative, "to the left." [2] Go *on* = move or start; negative, stop or rest. [3] Go *off* = recede; negative, approach. [4] Go *away* from home = have an undertaking in view; negative, homeward-bound. [5] Enquires between the positive or the negative idea; *e.g.*, • • • • = "Shall we go to the right or to the left?"

COMBINATIONS INDICATING POSSESSION.

•	I (or we) have	lunch	?
• • (or —)		water	no
• • •		the way	yes
• • • • (or — —)	You have	a view	

Way = path or good travelling. *View* = summit, outlook or any locality previously agreed on.

Always give all three members, or the message will be misunderstood. Thus, "We go off" (.. ... ...) would be converted into "Do not know" (.. ...) by omitting the third member. The interval between members must be longer than between the dots or dashes of the same member. To keep the **help** call unmistakable, *four dots are never used in the third member.* To avoid ambiguity, *never answer* **yes** *nor* **no** *to a question concerning motion.* A dash may be used for two dots, and two dashes in quick succession for four dots.

EXPLANATIONS.

The first member of both the tables may be exhibited in one column. To aid the memory, notice that no interchange of the meanings would give so many cases of equality between the number of dots and the number of letters.

1st Member — Motion and Possession.

·	I (or we) have
· · (or —)	We (or I) go
· · ·	You go
· · · · (or — —)	Thou hast (you have)

In general the dots will prove most easily remembered, al-

they are moving or resting, and whether they are setting forth or returning.

Among combinations indicating possession, "Have I lunch?" and "Have I water?" are unnecessary and not distinguishable respectively from Yes (. . .) and The Response (· — ·) given slowly. "You have lunch," (— — · — —) and "You have not lunch," (— — · —) being unnecessary pieces of information, may be used as signals to which temporary meanings may be attached by previous agreement. You have, or you have not water, the way, or a view, are used to reassure or caution a party in search of either, whose movements are watched by one knowing the ground. "Have I a view?" (· — — ·) is to be given its most general meaning "Is this the place?" "Do not know" in reply to "Have you water?" indicates a canteen or flask in distinction from a brook or spring. In reply to "Have you lunch?" it may also indicate a very limited supply.

The codes here recommended together comprise 8 simple signals, 44 combinations, expressing as many useful meanings, and 2 combinations to which special meanings may be temporarily attached by agreement, making a total of 54, exclusive of 2 combinations omitted for reasons named. Besides this, a chance is left to introduce other signals in the second member, with meanings especially suited to the circumstances.

The work of the Committee has been to consider its Chairman's original suggestions for conventional signals, and to take cognizance of the recommendations to be made in the other papers on signaling, which appear in this number. The result of the first has been the development of the system explained above. For the second part, the suggestions made by the respective writers have been compared before publication, with a view of ensuring harmony to the whole.

EDWARD C. PICKERING,
SAMUEL H. SCUDDER,
J. RAYNER EDMANDS, } *Committee.*

NOTE. The above forms a circular printed for general distribution in the mountains. The long and short codes are printed back to back, so that when the explanatory sentences are clipped from top and bottom and the margins reduced, we have a card for the pocket, containing what is needed to refresh the memory of one who already understands the system.

Sun Telegraphing.

BY E. T. QUIMBY.

Read October 9, 1878.

In exploring, in geodetic or topographic surveying, or on general excursions, parties on different mountains may facilitate their work or add to their pleasure by communicating with each other by means of the sunbeam. In prosecuting the Geodetic Survey in New Hampshire, the writer has successfully used heliotelegraphy for distances varying from five to fifty miles with much saving of time and expense.

It is the object of this paper to explain somewhat in detail the methods and code of signals employed, that members of the Club who may try this method of telegraphing may avoid as far as possible the vexations which the novice will usually encounter. The instrument used for this purpose is the heliotrope

(see page 56), and the method consists simply in so placing the instrument as to reflect the sunlight towards the friends with whom we wish to communicate, and in cutting off this light by some opaque object, by withdrawing which we may send short and long flashes for the dots and dashes of the Morse or some other alphabet.

Careful attention to the following suggestions will secure success.

1. *Learn thoroughly the alphabet, code of signals, and calls.*

In this matter let there be no trusting to writing the dots and dashes and reading them after the message is completed; for among other objections it renders a process, slow enough at best, intolerably slow. Use a field or opera glass in receiving, as this will often render reading easy, when otherwise it would be nearly or quite impossible.

2. *Learn not only to read well, but also to send well.*

The latter implies attention to the following points:

a. The careful setting of the heliotrope.

Telegraphing over the heads of the other party, or into the forest below is neither profitable nor pleasurable. Careful setting means also stability. The wind must not move the instrument.

b. Keeping the mirror in proper adjustment.

This should be attended to at the end of every word.

c. Proper relative lengths of the dots and dashes,[1] and of the intervals between letters and words.

The flash for a dot should be about half a second long, and a

[1] Mr. Edmands suggests that the rhythm be practised by counting. Suppose that the raising of the hand or other screen allows the light to pass. Let figures in the following example represent the counts, while their position, above or below, represents that of the screen. A change in the position of the figures then represents motion of the screen, while figures in parenthesis may denote counts on which there is no motion.

```
                      1   3 (4)(5)
A (dot, dash) . . . . 0   2         6 . . . .
                                                 1   3   5(6)(7)   9(10)(11)   13   15
Period (two dots, two dashes, two dots) . . . . 0   2   4          8            12   14   16 . . . .
                                   1              5    7
R (dot, space, two dots) . . . . 0     2 (3)(4)   6    8 . . . .
```

Thus for A, the screen, which is down at the start, rises at 1, falls at 2, rises at 3, remains raised through 4 and 5, and falls at 6, to remain in that position until the next letter. Do not try to learn the counts for each letter. This is a mere exercise to acquire *rhythm*, without which (however unconsciously conformed to) one cannot send well.

dash two or three times as long. The interval between letters may be as long as a dash, while the intervals between words, will vary according to the time required to re-adjust the mirror. This must not be forgotten.

d. Complete obscuration of light between the flashes.

If the hand be used, see that no light shines through between the fingers, and that it be not carried too far so as to show an unintentional flash. The "mountain heliotrope" carries a stop by which this danger is avoided.

After becoming skilled in sending and receiving, the calls and signals at the end of this paper should be used as follows:

Suppose some Appalachian desires to communicate with the party of the U. S. Geodetic Survey. Having ascended a summit from which the station occupied by the survey party is visible, first place the heliotrope upon some point whose situation affords facilities for conveniently handling the instrument. Care must be taken that it be properly directed, and then made stable by loading with stones.

When all ready, throw a steady beam of light towards the Geodetic station. Your light can scarcely remain unobserved five minutes, whether expected or not, and as soon as seen an answering beam is sent in reply, cloud shadows not preventing. This tells you that your light is seen, and you immediately shut off light. The survey party will then do the same, showing you that they have noticed your "shut off," and are waiting your further pleasure. You then call *Q Q Q* and sign *A*, or or some private call, as the case may be, by which the survey is apprized of your desire to send a message, and to which they answer either by *o k* or *g a* and sign *Q*. Each party, in all cases, after replying and while waiting for an answer, or while receiving, keeps light shut off. Having received the word to "go ahead," you begin with a period to put the survey party on the *qui vive*, and proceed with your message, observing at the end of each word the adjustment of the mirror, and re-adjusting if necessary. When the message is completed give a period and sign *A*. If understood by the Survey, you will get in return *o k* and then a period and the reply. While adjusting the mirror to reply, it is quite as well to keep the

light "on," that is, allowing the other party to see the irregular flashes which such adjustment will give. In that way they follow your motions as well or better than when they wait for you to adjust with your light "off."

Also in telegraphing keep sharp lookout for the light of the other party, for if that be seen you must stop to see what is wanted, keeping your light off. After you have stopped telegraphing, either you will soon get *r r* for repeat from the beginning, or some word will be sent back to you as the last that was read. You will then go back, and beginning with that word go on as before. Or you may get besides the last word read, *m l*, or 5 5, which will indicate the reason for failure to read. If you make a mistake in sending, you will make a succession of short flashes of no definite number, and then begin back far enough to correct the mistake.

When the light of the Appalachian is to be observed upon, follow the special directions given on page 69.

MORSE ALPHABET.

A	- —	J	— - — -	S	- - -
B	— - - -	K	— - —	T	—
C	- - -	L	——	U	- - —
D	— - -	M	— —	V	- - - —
E	-	N	— -	W	- — —
F	- — -	O	- -	X	- — - -
G	— — -	P	- - - - -	Y	- - - -
H	- - - -	Q	- - — -	Z	- - - -
I	- -	R	- - -	&	- - - -
1	- — — -	5	— — —	8	— - - - -
2	- - — - -	6	- - - - - -	9	— - - —
3	- - - — -	7	— — - -	0	———
4	- - - - —				

Period - - — — - -   Comma - — - —   Interrogation — - - — -

SIGNALS.

Repeat, (r r)	- - - - - -	Wait, (1 1)	- — — - - — — -
All right, (o k)	- - — - —	Slower, (5 5)	— — — — — —
Go ahead, (g a)	— — - - —	More light, (m l)	— — ——

Observation finished, (s s s) - - -   - - -   - - -

Good-bye (two commas) - — - —   - — - —

CALLS.

Appalachian, (A) - — U. S. Geodetic Survey, (Q) - - — -

ABBREVIATIONS.

You,	u	Observe, or observed,	o b s
Are,	r	Observation,	o b s n
Be,	b	Primary,	1 r y
Going,	g g	Secondary,	2 r y
Tomorrow,	t m w	Tertiary,	3 r y
Thought, or that,	t t	Degrees,	d
Thanks,	t k s	Minutes,	m
Think,	t k	Seconds,	s

.The Mountain Heliotrope.

By J. Rayner Edmands.

The heliotrope is an instrument by which the light of the sun may be reflected by a mirror towards any desired point. Seen at a distance the light resembles a star.

In its simplest form the instrument consists of a wooden bar, upon which are supported two diaphragms and the mirror. In each diaphragm is an aperture, and the mirror is to be set in such a position as to reflect the sunlight through them. To this is added any convenient arrangement of sights, by which the line joining the centres of the apertures may be made to point in any desired direction.

The instrument is first pointed in the right direction by sighting, and is loaded with a stone to keep it firm, and then the mirror is adjusted. When nearly right, the light passing the aperture in the first diaphragm will shine partly upon the surface of the forward one, but the mirror may be moved till the reflected light passes through the second aperture also, barely touching the edges. It is then sending in the direction in which the instrument has been pointed. As the apparent position of the sun changes, the crescent of light will appear upon one side of the forward aperture, denoting that the mirror is no longer at the correct angle. It therefore has to be frequently looked after and re-set, taking care, however, *not to change the pointing* of the instrument.

By having the instrument placed on, or in line with, a station of a survey we have the means of pointing a telescope directly toward the station; but the instrument also has its popular uses. By interposing any opaque object in front of the diaphragm, the light is cut off without disturbing the adjustment; and by alternately removing and interposing the stop, signals of special meaning may be given. For instance, with the signals recommended by the committee, a mountain party with a heliotrope may easily relieve anxiety at the hotel as to whether they are to be expected to return or to proceed farther. Or, the alphabet being learned, any message may be actually spelled out with the instrument. For further explanation of this, see papers commencing on pages 49, 52, and 68, respectively, of this number.

The instrument may take many forms. Surveying parties find an attachment to the reconnoitring telescope most convenient; active mountain climbers will be willing to incur the expense of a genuine pocket instrument; but the majority of our members will probably prefer an inexpensive and simple, yet portable arrangement. Prof. E. T. Quimby, and the writer, have devised such a heliotrope, and have found a man who will furnish the instruments for a reasonable price.[1]

The wooden bar is about 40 cm. (16 in.) long, 7 cm. ($2\frac{3}{4}$ in.) wide, and 16 mm. ($\frac{5}{8}$ in.) thick, and all the parts pack firmly upon it, augmenting the thickness for transportation to 3 cm. ($1\frac{1}{8}$ in.) The forward, or second, diaphragm is of tin, erecting on a hinge, and having an aperture of 4 cm. ($1\frac{1}{2}$ in.) diameter, whose centre is 13 cm. (5 in.) above the upper surface of the bar. The rear, or first, diaphragm is similarly arranged in those respects, except that the tin extends in but a thin ring around the aperture, in order to avoid the shadow which sometimes would be cast upon the mirror. The distance between diaphragms is 37 cm. ($14\frac{1}{2}$ in.) For sighting, wires are fastened across the centres of the apertures. Holes are also drilled, by which, if a wire be broken, thread may be stretched across the aperture for the same purpose. The mirror is 20 cm. (8 in.) long, and 5 cm. (2 in.)

[1] Apply to the Secretary.

wide, and so mounted that its smallest dimension is always transverse to the line of centres of the apertures, its fixed axis of rotation being in that line. This dispenses with the extra width of mirror which would be necessary were one axis of rotation always vertical. The forward diaphragm carries a stop, by which the light may be alternately shown and cut off for signaling purposes, the arrangement being such that the mirror may be adjusted whether the light be on or off. For carrying, the diaphragms shut down over the dismounted mirror, and a pin fastens the whole. And this pin has its place on the instrument arranged for signaling, serving to limit the motion of the stop.

The mirror is as long as practicable, in order that we may send nearly opposite to the sun without using a second mirror. In extreme cases the full area of the aperture will not be utilized; but a part of this reduction in the intensity of light would be met in other arrangements by the extra absorption of a second mirror. For sending nearly in the direction from which the sun is shining, the ends of the mirror must be covered so that none of the light reflected by the mirror shall shine by the side of the forward diaphragm. Otherwise, the stop would not cut off all the light. Take two pieces of cloth, each a trifle wider, and half to five-eighths as long as the mirror. In each case fold about one-third the length of the cloth over upon itself, and sew like a bag. These will cover more or less of the mirror, according as the longer or the shorter side is placed upon the front. Cords from the corners, by which the bags may be connected when in place, will prevent them from blowing off. In packing, these bags may be left upon the mirror.

Directions. Unscrew and remove the pin (the one whose head is not partly filed away) midway the length of bar. Erect the diaphragms and remove the loose pieces underneath. Replace the pin in the forward diaphragm. Attach the mirror to the bent rod and the rod to the rear end of the bar. Place the instrument upon any convenient support (a boulder for example) and point it in the general direction of the point toward which light is to be sent, propping and loading with stones. Look into the mirror and move it till the vicinity of the distant

point is seen through the aperture. Then slowly move the instrument and the eye, until the distant point and the centres of the apertures are seen all three in the same line. The cross wires define the centre. Move the mirror until the sunlight passes through the rear aperture, and notice where it strikes the forward diaphragm. Then move the mirror until the circle of light is concentric with the aperture, or with the circle painted upon the stop. To verify the pointing of the instrument without disturbing the mirror, place the head between the sun and the mirror, look into the latter, and move the head till one eye sees along the sights, which should be in line with the object pointed at.

For examples of the use of the heliotrope see the papers referred to above.

Profiles from Monadnock, Adams, and Owl's Head.

Description of Plates I. and II.

By J. Rayner Edmands.

These profiles, taken with the topographical camera from Monadnock, Adams, and Owl's Head, originally appeared in the atlas accompanying Prof. Hitchcock's Geology of New Hampshire. A portion of the view from Monadnock has already appeared in Appalachia.[1] In the description there given occurs the sentence:[2] "A greater source of error arises from the liability to mistake an insignificant for an important ridge-line, to omit a ridge entirely, or to fail to follow with the pencil the minutest matters of form." This is strikingly illustrated by comparing the form of Monadnock Lake on the old sheet with that on the new. On the former a shadow-line on the water appears as the shore of the lake, while the real shore simulates a hill, which frequenters of the region found it difficult to account for. The error is corrected on the present sheet. Any information as to other errors will be welcome. The following remarks are taken from the explanations accompanying the sheet in the atlas.

With the exception of that from Monadnock, the profiles are published on a scale of about five millimeters to the degree;

[1] Vol. I., Pl. XI. [2] Vol. I., p. 271.

but the scale attached to each is intended to compensate for unavoidable variations. To measure horizontal angles with the greatest attainable accuracy, use an ordinary metric scale; but in addition to the desired angle, measure with it the angular distance upon the attached scale between two graduations nearly under the two points. The difference between the nominal angular distance on the attached scale and its measured angular distance, as given by the scale used, should be applied, with the proper sign as a correction to the angle measured upon the profile. Horizontal angles may be conveniently measured to tenths of a degree. For readiness of identification, the zero of the attached scale is made to coincide as nearly as may be with the south, so that its readings shall give directly the geodetic azimuth. The profile from Monadnock is on a scale of about one centimeter to the degree, or twice that of the others; but for the part of the view to the right of Belknap, the data are wanting for the precise scale. Also, the position of the horizon is not so well known for the second line of profile from Monadnock, as for the others. On the other hand, the distant view from Monadnock, extending between the Franconia and Ossipee ranges, has received more careful treatment than anything else upon the sheet.

Any identified point not on the sky-line may be found on the profile by means of its vertical position, given before the name. For this purpose, mark off from the zero of a short paper scale the distance between the horizon and the bottom of the profile, this distance being shown at either end of the sheet. Then, if this mark be placed anywhere upon the bottom line (the scale running in the direction of verticals), the zero will indicate the level of the occupied point; and the vertical position of the point sought may be read directly upon the scale.

Distances, when given, are expressed in kilometers, the number being enclosed in brackets. Conspicuous unidentified points are arbitrarily lettered, for convenience in defining future identifications.

Secretary's Report for 1878.

By the new By-Laws of the Club, the Secretary is required to present as his Report an annual history of the Club, and in doing so I will mention first, as the most important event of the year, the change of organization of which these By-Laws are one of the incidental results. By this change the Club has become a corporation, instead of an irresponsible voluntary association. It has attained through greater responsibility a more dignified and stable position in the community. It can, by virtue of this legal establishment, hold and defend a legal title to any property of which it may become possessed, as a means of advancing the ends for which it has been formed, and this may be expected to inspire confidence on the part of persons who may become sufficiently interested in its work to be inclined to aid it by gifts of land or funds, that such gifts will be safely bestowed.

In accomplishing this reorganization it was necessary for each member of the original association, who desired to continue his membership, to voluntarily become, by written agreement, a member of the corporation, and this was the means of sifting our list of members and eliminating those of doubtful standing. I stated in my last report that the number of active members was 189; but owing to the omission from our Constitution, as it then stood, of any provision for dropping delinquent members, this number should be received as an estimate rather than the result of an actual enumeration. Probably the number of those who had any real intention of continuing their membership was at that time not more than 150. There are now 164 members of the Corporation; 36 members of the unincorporated Club have not been heard from as to whether they wish to join the Corporation or not; and out of 46 elected to membership during the last three months, only 20 have yet been heard from, leaving 26 who are still doubtful. During the year four corresponding members have been added, making the present number 27. Two of our honorary members have died, reducing the number to nine. It may seem from these figures that the reorganization has been

the means of reducing our membership, but I think it should rather be looked upon as a test, which determined who were really members and who were not, and that the fact that so young a society has stood this test so well, should be considered an encouraging sign; for it must always happen in the first organization of any society, whose plan is a novelty in the community in which it is established, that many persons will be drawn in, through a misconception of its nature, who afterwards find that they have no real interest in it; but it will also happen that many will hold off for a similar reason, who may afterwards be expected to become among its most interested members, and this should lead us to hope that as the Club becomes better known its membership will not only increase in number, but also that the average earnestness of interest among its members will also increase. I would suggest, as a further step towards a more definite understanding of the actual status of persons on the list of members, that the By-Laws be amended by the addition of an article providing a form of withdrawal from membership, so that a member wishing to discontinue his connection with the Club, may understand that he is expected to give formal notice of the fact.

There have been held during the year nine regular meetings, and two field meetings, the former at the Mass. Institute of Technology, in Boston, the latter at the Fabyan House, and at North Conway, N. H. Besides these, excursions have been made to Blue Hill, Milton, and to Mt. Wachusett. An exhibition of pictures was also held at the rooms of the Boston Art Club, which were kindly placed at our disposal for the purpose. And last, but by no means least in importance, a course of six lectures on Natural Scenery has been given under the auspices of the Club, by Prof. Wm. H. Niles, which attracted, and retained throughout, a large and interested audience, and it is much to be desired that so effective a means of stimulating the interest of the public in the Club may be continued in future seasons.

The library of the Club has increased considerably during the year, and it is hoped that persons having books or maps of

use to the Club, which they can spare, will look upon this library as a proper and safe place for them.

The operations of the Club are still much restricted by lack of necessary funds. A Committee of Ways and Means has been appointed, and through its exertions as a committee and the personal efforts of its members a good beginning has already been made, especially, as will be seen by reference to the report of the Councillor of Improvements, in the matter of raising money for special pieces of work. The Committee also hope to obtain recognition of the Club from the railroads, in the shape of reduced rates to members going to and returning from field meetings, and to members and employes engaged in explorations and improvements under its direction.

One number of APPALACHIA has appeared, but it was necessary to omit the second, which would otherwise have appeared in the early summer, on account of insufficient funds. It is much to be regretted that the Club has not at its disposal sufficient funds to ensure the publication of the material which is constantly accumulating, and which, if published, would be of interest and advantage to many persons, besides serving to make known the work of the Club to many who otherwise would not know of it. I should like to take this opportunity to urge upon the attention of members, and others interested in our work, the importance of raising a permanent fund for this purpose.

Perhaps it will not be out of place for me also to call attention to the desirability of a fund for the maintenance of suitable rooms, where the members of the Club could meet each other at other times than those of the meetings, and where the books and maps, and other property of the Club, would be always accessible for consultation. A few hundred dollars a year would be amply sufficient for all present needs of the Club, and would relieve us of the necessity of depending upon the hospitality of the Institute of Technology, which has now accommodated us rent free for three years.

Respectfully submitted,

J. B. HENCK, JR., *Secretary.*

Treasurer's Report for 1878.

The receipts for the year ending Jan. 8, 1879, were as follows:

Balance on hand January 9, 1878	$1.13	
Rec'd for admission fees and assessments[1]	318.00	
Rec'd by Sec. and Treas. on acc't of Appalachia	47.50	
Rec'd from Houghton, Osgood & Co., for Appalachia	28.20	
Rec'd for two life memberships[2]	60.00	
Contributions collected by Miss E. J. Baker.	8.00	
Contributions collected for the Committee of Ways and Means, by Prof. C. E. Fay	35.00	
Total receipts in 1878		$497.83

The expenditures were as follows:

Feb. 9.	Paid	A. A. Kingman for printing postal cards, notices, etc.	$53.72	
" 13.	"	Norris Peters for photo-lithographing, and copying map for Appalachia, No. 4	8.00	
" "	"	H. F. Walling for postage, etc., in 1877	8.75	
May 10.	"	A. A. Kingman for printing and binding Appalachia, No. 4	134.30	
July 2.	"	A. A. Kingman for printing notices, circulars, etc.,	53.79	
Nov. 13.	"	A. A. Kingman on account of printing	32.28	
" "	"	J. R. Edmands for expenses of topographical department	2.00	
" 27.	"	J. B. Henck, Jr., for postage, envelopes, charter fee, etc.	30.33	
Dec. 11.	"	John Worcester for expense of art exhibition	52.48	
" 13.	"	H. F. Walling for postage, envelopes, express charges, etc., in 1878	15.29	
" 14.	"	J. B. Henck, Jr., for postage, etc.	8.15	
" 31.	"	C. E. Lowe for cutting path on Mt. Willey	20.00	
" "	"	Boston Heliotype Co. for profiles for Appalachia, No. 4	27.50	
Total expenditure in 1878				$446.59
Unexpended balance in hands of Committee of Ways and Means				15.00
Cash balance on hand Jan. 8, 1879				36.24
				$497.83

[1] Of this amount $54 was for admission fees of twenty-seven members elected in the latter part of 1878, who are thus exempt according to Art. XIII of the Constitution, from the assessment of 1879.

[2] Of this amount, $30 was advanced by one not elected to membership until after the close of the year.

Reports of the Councillors.

Natural History.

BY J. H. HUNTINGTON.

Read April 9, 1879.

Members of the Club who are interested in Natural History, and those who desire that this department should receive the attention that its importance demands, have opportunities, which, if improved, may be fruitful in grand results. It is my purpose to point out briefly some things that can be done. The subject of Geology naturally attracts our attention first, as the great physical features of every country depend on its geological structure. We have now a general knowledge of the geology of New England, and I may say that there are very few localities which have been studied otherwise than in a general way, hence everywhere that members of the Club may go, they will find a field where they can gather new facts that will add very much to the knowledge of the region they study, and may also throw light on some obscure points in geology. Members of the Club who have only a slight knowledge of rocks can often do good service, if they are willing workers, and can have some things of interest pointed out in the region they are to visit, from which to begin their work. Students of geology, by having a general knowledge of the region they are to visit, will always find something of interest, and something new, either in the rocks or in the drift.

There are now many incentives to study geology. We have the great volumes of the geological survey of New Hampshire, and the geological map of the State, these can be consulted either before we start on our summer trips, or they can be found with every town clerk in the State. The different formations are laid down on the map chiefly from lithological distinctions, so that when a given group of rocks becomes familiar they can readily be traced. In the New Hampshire report, Professor Hitchcock has taken it for granted that the porphyritic gneiss of the State is a stratified rock, and he has placed it at the base of his system. There are those who believe that this rock is eruptive, and not stratified at all, otherwise than as a su-

perinduced structure common to many eruptive rocks. A careful study of it along its border, especially where contacts can be found, will solve the question. Facts in regard to contacts are what we want especially. Interesting points for the study of this rock will be found in Fitzwilliam, in Holderness, west of Squam Lake, in Albany, south of the Intervale, near Shackford's, and in Maine. Saddleback Mountain is an interesting point. By following the border of any of the formations, much can be learned.

Many persons are interested in the study of the drift, who are not interested in other departments of geology. Mr. W. Upham, by his excellent treatise on this subject in Vol. III, of the New Hampshire Report, has given a new impulse to this study, and there are very many interesting fields, especially in Maine, that are yet to be explored. The gravel ridges, like those found in the upper Connecticut valley, and those so common along the rivers in Maine, where they are known as "horsebacks," are to be distinguished from the great ridges running directly across the country, without reference to the valleys. We want for the purpose of studying the plants and insects, a map of the whole of New England, which shall show the different kinds of drift, and the different soils. By some systematic work on the part of the members of the Club, very much can be accomplished towards making such a map. I have once before called the attention of the Club to the peculiar arrrangement of lines of stones near the summit of Mt. Washington. These can be seen along the Alpine Garden, also from the base of the cone towards Boott Spur, and towards the Lake of the Clouds. A map showing these is something very much to be desired.

What I have already mentioned is for our own pleasure and profit, but we *owe* something, we owe a debt to the Massachusetts Institute of Technology. Last summer the members of the Club were scattered from Maine to California, while some were climbing the Alps, or travelling in other parts of Europe. Now suppose each member of the Club, those who were far away, and those who were not far from home, had collected a few specimens of rocks characteristic of the most interesting localities they visited, and in the autumn we had

presented them to the Institute. If these specimens had been carefully collected and nicely trimmed, we should not only have shown our good will, but we should have given something that had an intrinsic value. If this practice were continued, in a few years we should have gathered a collection which, for the purpose of study, could scarcely be excelled. The specimens, except fossils, should be 100 mm. by 75 mm., with fragments for making their section. The difficulty in the way of getting suitable specimens, will often be the want of a good hammer, so when an excursion is to be made to an interesting locality, one will have to be provided for the purpose. In every instance note the exact locality where the specimen is obtained, for its value will depend upon this, and get specimens from ledges, not from boulders, unless you are in a country where there has been no ice sheet or glaciers.

In botany we want to know more exactly about the limits of the different kinds of vegetation, and something more about the effects of different soils upon their growth. There are many regions that need yet to be explored. A few days spent in King's ravine, and on the north side of the mountains, ought to be fruitful in good results.

With the exception of botany, entomology has received more attention than any other department of natural science, yet we do not know enough about the life history of the two White Mountain butterflies, the *Œneis semidea* and *Brenthis Montinus*. Our ex-President, Mr. S. H. Scudder, is desirous of obtaining the eggs, especially of the first, and offers a reward of five dollars to any member of the Club who will bring him the living eggs of the *Œneis semidea*, and he suggests the following method for obtaining them. Take a keg and put in a sod from near the summit of Mt. Washington, that is well set with the *Carex rigida*, catch a gravid female of this species, put it in the keg, then cover the keg with muslin, and let the butterfly remain until it dies. The eggs of the *Œneis* can probably be obtained from the 15th to the last of July, and those of *Brenthis*, the latter half of August.

Of birds, it is important that something very definite should be known as to their range during the breeding season.

It has been suggested that details of scientific work go naturally before more purely scientific bodies. If so, then let us have popular accounts of scientific work. We can have our facts in geology embellished with some of the poetry of the rocks, our facts in botany adorned with the brilliant coloring of our high Alpine plants, and our facts in biology enlivened by the blithesome song of birds, and the music of the insects.

Reports of the Councillors.

Topography.

BY J. RAYNER EDMANDS.

Read May 14, 1879.

The department still devotes most of its attention to completing the triangulation of the White Mountain region, covering the country with a well distributed system of carefully determined points to serve as stations for subsequent work. We still look to the government survey for many of the principal points, but the department finds ample work in supplementing it. A sufficient number of stations is already known to furnish a basis upon which members may do much detail surveying. Information concerning them will be furnished to those desiring it.

The department has the custody of several instruments, which are at the service of members wishing to use them. The experience of last year has taught that it is necessary for members to give early notice of the time when they desire these instruments. In this connection the Club is especially indebted to Mrs. Jared Sparks, for the gift of forty-five dollars, with which to construct a topographical camera. The instrument was made and used last year, and members are invited to keep it busy this season.

Attention is called to the heliotrope as a substitute for set signals. It is commonly used for very long distances, but your Councillor has suggested its general employment to avoid the expense of erecting signals, even where the distance to be sighted is short. A convenient form of instrument for this pur-

pose is described on page 56. The directions appended to this report were issued last summer with a view to coöperation between Appalachians with heliotropes, and the observers of the U. S. Geodetic Survey. The results were gratifying, in spite of the short notice given to members, and of the hazy weather which interfered with the plans of many. We are fast coming to consider the haze and smoke as practically greater hindrance than fog and rain, rendering expeditions unsuccessful, instead of necessitating their postponement.

We are indebted to Profs. M. C. Fernald, and W. A. Pike, for the location of Mt. Katahdin, in Maine, a summit whose position will especially interest many.

Mt. Katahdin.	Latitude	45° 53′ 40″ N.
	Longitude	68° 54′ 51″ W.
	Height 5248 ft. = 1600 metres.	

From these figures, and the Coast Survey location of Mt. Washington, we calculate:

Distance from Mt. Washington	259 km. (161 miles) about.	
Bearing from "		N. 46° 12′ E.

Concerning the position of an eminence capable of obstructing the sight between these two summits, see page 43.

For special mention of plans for the summer, operations of government surveys, etc., members are referred to the summer circular, which will be issued early in July. When uninformed of the Councillor's whereabouts, address him at 46 Federal Street, Boston.

INSTRUCTIONS FOR HELIOTROPING.

The scheme is to avoid, in part, the necessity for erecting signals, by visiting the points to be located, while a party is observing at some station from which the points are visible. Appalachians may thus visit several in a single day, marking each point permanently upon the rock (A), and with a heliotrope sending the reflected sunlight (B) by which the precise directions can be observed. As far as possible the observing party will be informed of the intentions of the signalling party, but a general lookout will also be kept by the former for unexpected lights, and a simple code of signals (C) will help the two parties to understand each other. The point sighted will be denoted in the field-book of the observer by the date and hour set against the corresponding readings of the instrument. It will afterward be identified by consulting a copy of the diary (E) of the signalling party.

Select and mark the station with care (A), set the heliotrope precisely in line, and send the light to the observers (B). Persevere in this as long as is consistent with the day's plans, even if the observers do not reply, for they may be in shadow and unable to reply even though they can observe you. When about to leave the station, signal "the finish"; but should "the beam" or "flashes" be received in reply (C), delay departure, if possible. A beam from the observer may also be a request for a stronger light, or an inquiry whether you intend them to observe you. Hence, when a beam is thus received from the observers, cut off your light while you readjust the mirror, then send the Appalachian call (· — · —), and then the beam as before. The observers may also use the beam to request a repetition of your light.

A. Selecting and marking the point.

Pay attention to the visibility of other important points. Where possible, let the precise point be recommended by some natural feature, so that another person would be likely to find it without having to refer to the particular description. To thoroughly mark the point, in the manner recommended by Prof. Quimby, of the U. S. Geodetic Survey, drill a $\frac{5}{8}$ inch hole (or thereabouts), 3 or 4 inches deep, and drive (or set with lead or sulphur) an iron bolt projecting 3 inches above the ledge; also cut an equilateral triangle in the rock around the bolt (say each side 9 inches), one of the sides being north and south and the opposite vertex pointing to the east. Where disinclined or unable to do this, make a hole about an inch deep surrounded by an equilateral triangle of not less than 5 inches side. The village blacksmith will lend or let the tools.

B. The heliotrope. See page 56.

C. Code of signals.

The Beam. An uninterrupted light intended to be sighted on, and never sent toward a party known to have an observing instrument, unless the heliotrope be set exactly on or in line with the station, except as a call before their light has been seen, or as a well understood signal during conversation with the alphabet.

Flashes. Lights of about half a second duration, regularly interrupted by dark intervals of about the same length. *Never to be observed upon.* May therefore be used instead of the beam, to denote that the heliotrope is not set in line.

The Finish. Three flashes at a time, repeated at intervals of a few seconds. Three triplets are recommended, thus: (... ... ...)

The Appalachian Call. A dot and a dash; *i. e.*, a short flash followed by a light of longer duration. It is recommended to give it twice, (· — · —).

D. When the signallers also desire to observe.

Observers permanently located at a station may send "the beam", even from an eccentric position, unless notified that their light is desired for ob-

servation. This notice will be sent to them by setting the heliotrope in line, and alternately flashing and beaming for a few seconds each. A continued beam from the stationary party would then leave doubt whether the notice is seen; but a change to "flashes" will show that although the notice has been seen, it has not been convenient to set the heliotrope in line, while alternate flashes and beams will indicate that they are ready to be observed. After the parties have thus exchanged signals, it will be convenient to return to the plain beam, but neither will then be at liberty to send the beam unless the heliotrope be properly set in line. Alternate flashes and beams will then call for "more light."

E. The Diary.

Describe everything to which attention has been called in the directions for selecting the point, with especial reference to enabling another person to find the point with ease and certainty. Make, if practicable, an eye-sketch showing the topography of the immediate vicinity of the station by approximate contours about every ten feet. Give the name which attaches to the summit or to some point near it. Give duplicate names when they exist, with any ascertained facts touching the same. Note as nearly as convenient the magnetic bearing of the station signalled to, as well as the bearings of prominent mountains, hills, or other objects. Keep a minute record of operations, especially timing the signals received and sent. Send copies promptly to the occupied station and to the Topographical Department of the Club.

Reports of the Councillors.

Art.

BY MRS. PHEBE M. KENDALL.

Read April 9, 1879.

The Department of Art can only repeat the suggestion, which has been made from time to time, that during the summer sketches shall be made of views in the mountain regions for the benefit of the Club.

As former appeals of this kind have met with little or no response, it is suggested that in the Autumn, after our return from our mountain tours, we shall have one afternoon devoted exclusively to relating summer experiences; accounts of pedestrian excursions, camp life, &c., and that members shall bring their sketch books, which can be looked over without the formality of a public exhibition.

Now that instruction in drawing has become a part of the

regular work in our schools, there is no reason why children should not occupy a portion of the time in the long summer vacation in sketching the scenery about them. We commend this to Appalachian workers who can thus train up new members for our Club, and, by giving the children something to do, counteract in part the demoralizing effect of a three months' vacation.

The Councillor in Art will be very happy to receive any suggestions by which work in this department can be made more effective, and invites the coöperation of all Appalachians, who, whether geologists, topographers, botanists, or engineers, are all lovers of Nature, and as such, all belong to the Art Department.

Reports of the Councillors.

Exploration.

By Charles E. Fay.

Read April 9, 1879.

The original Councillors in the several departments were more fortunate than their successors in having a fresh field to which to invite the labors of their constituents. It will be found, I think, that in nearly every instance they proved themselves equal to the occasion, and laid out plans far-reaching enough to cover the work of many summers. Little, therefore, is left for their successors save to compare the amount of work accomplished with their statement of desiderata, and suggest what portion of the unperformed work would better receive attention for the ensuing season. It is evident that there is greater likelihood of attaining tangible results, if while not restricting the field of possibilities, we fix upon a few definite plans and determine that these, at least, shall not fail of execution.

Referring to the report of Mr. Pourtales for the summer of 1876 (Appalachia, Vol. I., p. 49), I find thirteen districts in New Hampshire suggested as profitable for exploration. A comparison with the record of the proceedings of the Club shows that we have heard, more or less fully, in the way of papers pre-

sented or reports rendered, from eight out of the thirteen. The accompanying table presents these thirteen districts, and under each the reports made, if any, and their authors.

1. The region north of Dixville Notch.

Prof. J. H. Huntington.—Explorations at the sources of the Connecticut River.

2. The Pilot Range.

3. The Pliny and Randolph Mts.

Messrs. J. R. Edmands and C. E. Lowe.—A visit to the western summit of the Randolph Mountains.

4. The region north and east of the Androscoggin.

Prof. J. H. Huntington.—The Magalloway River. Mr. W. H. Pickering.—Explorations about Speckled Mountain in Maine.

5. The mountains east of Wild River, and between the Androscoggin and Mountain Pond.

6. The valleys of Mt. Washington River and Rocky Branch, and the range from Boott's Spur to Iron Mountain.

Rev. J. Worcester.—Explorations on the Rocky Branch.

7. The range from Mt. Deception to Mitten Mt.

8. The Castellated Ridge (Mt. Jefferson), with its adjacent ravines.

9. The region between Sawyer's River and Moat Mt., and the western slope of the latter.

Mr. J. B. Henck, Jr.—Ascent of Mt. Tremont. (App. I, p. 124.)

10. The region between Tripyramid, Chocorua, and Black Mts., and between Green's Cliff, Mts. Hancock, Tripyramid, and Osceola.

Prof. C. E. Fay.—A Day on Tripyramid. (App. I, p. 14.)

11. The northern slopes and intervening valleys between Mts. Lafayette and Willard.

12. The valley of the East Branch of the Pemigewasset.

Mr. W. Upham. The East Branch of the Pemigewasset; Unnamed Mountains between Mt. Hancock and Scar Ridge. (App. I, pp. 39, 252.) Profs. F. W. Clarke and G. Lanza.— Ascent of Scar Ridge. (App. I, p. 247.)

13. The region between Moosilauke and Cannon Mts.

Profs. F. W. Clarke and C. R. Cross.— Explorations about Mt. Kinsman.
Prof. G. Lanza.— The Kinsman Slide.

In justice to the enterprise and zeal of several of our members, it should not be forgotten that several other papers have been presented narrating explorations made in more distant fields, and some indeed in portions of the White Mountain region not fully explored, but less unfamiliar than the districts mentioned. It will be seen that no reports have been received from the Pilot Range (2); the mountains east of Wild River,

and between it and Mountain Pond (5); the range from Mt. Deception to Mitten Mt. (7); the Castellated Ridge and its adjacent ravines (8); the northern slopes and intervening valleys between Mts. Lafayette and Willard (11.)

No detailed report has been made of perhaps any one of these districts, the papers read having related to excursions made to some parts of them. This is, however, what is to be expected, and all that the department asks. The collating of accurate reports of such excursions will furnish eventually the detailed knowledge that we desire to possess and disseminate.

There are two of these districts to which especial attention is called for work during the ensuing summer, — those numbered 10 and 13 in the foregoing table.

To the first of these we are especially invited by the promised immediate construction of the path from Livermore to Waterville. This path running just west of Green's Cliff and near the head-waters of Swift River, will pass through the centre of this district. It has been proposed that, in connection with the intended field-meeting at North Conway in July, a party be formed to proceed to the rendezvous by way of Sandwich, Waterville, and the new path. Such a party, if provided with sufficient equipage to spend a night or two in the woods, could make reconnoissances to the right and left. It is hoped also that other parties making use of this path will do the same.

The other district, 13, has a claim upon our immediate attention, inasmuch as in it will be located the next path of considerable length that the Club seems called upon to construct; that from Woodstock to the foot of Mt. Moosilauke in Warren. When this is completed, we shall have the satisfaction of having joined, by furnishing the missing links, the Saco and Baker's River valleys. Before this path can be located, the region should be carefully reconnoitred. This is not an enterprise that we can afford to leave to the chance of some members being in the upper part of the Pemigewasset valley. Some of our indefatigable workers are invited and urged to betake themselves to that section, and do the necessary labor. The beauty of the region will well repay any who shall determine to turn their attention in this direction for a shorter or longer

time. Mr. Merrill's inn, at the foot of the Moosilauke carriage-road, would be perhaps as good a rendezvous as Woodstock for the general exploration of this region.

While laying especial stress on these two regions, I would suggest that good service could be rendered if individual members would determine that in the autumn the Club should hear something at least from each of the sections from which as yet we have had no report. As fresh fields they seem to offer special inducements to the explorer. If members are to be settled for a few weeks on the borders of any of these districts, will they not make an effort to explore them, even though superficially, not forgetting to take notes and report them.

For the manner in which to make a report one may find good examples among those appended to the Report of Mr. Edmands as Councillor of the department in the autumn of 1876. (Appalachia, Vol. I., p. 117.) In the very full list of the desiderata in the department of Natural History presented by Dr. T. S. Hunt, (Appalachia, Vol. I., p. 35), one will find numerous suggestions as to points for which the intelligent explorer should be upon the lookout. In short, he who desires to do the best work in this field, can do no better than to provide himself with a copy of that report, and those of my predecessors, and the "mountain circular" issued in 1878.

HEDGEHOG CHASM. BY W. H. PICKERING.

Late in the summer of 1877, while staying at Campton Village, I heard of a great cleft, which was said to exist in a little mountain not eight miles away, and known as Mt. Hedgehog. This cleft had been discovered by three men independently, at different times, on each occasion the discoverer himself being lost. Two of the men had subsequently tried in vain to return to it. I obtained a description of its general appearance from the third man, and at length induced him to go with me in search of it. Our party left Campton early in the morning of Sept. 10, for Elkins's, which is the last house on the Mill Brook road. Here we met our guide, and were soon on our way up the steep slopes of Mt. Hedgehog. After an hour's fruitless search we heard a shout from one of the party, and running forward found him standing on a broad ledge of bare rock, down the very middle of which extended a long broad crevice. This was immediately identified by the guide as the place found by him some twenty years

before. At one end he said grew two slender saplings: here we now found two sturdy full grown trees. I was let down into the chasm at one end, by means of a branch of a tree, and traversed its full length. It was very dark, and nothing but a narrow strip of light behind me indicated the opening. Near the entrance I found quantities of "daddy-long-legs," which had probably never before been disturbed by man or beast since the chasm was formed. So narrow is it at the bottom, that I had to climb over one of my companions in order to pass him, and we called to the rest not to come in till we had got out. Measurements were made with a cord brought for the purpose. We found it to be 90 ft. in length, 55 in depth, and one to two in breadth, at the top, and about six inches at the bottom.

Like the flume, it has a large boulder suspended between its walls, four or five feet in diameter. There is also another and smaller boulder suspended higher up. The best way to reach this spot in future, would be to strike the long ridge running westerly from Mt. Hedgehog, rather more than half way up, and then follow it up to the chasm. The latter is on the very edge of the ridge, and one could not miss it. Its position is marked by a solitary blazed pine tree which was then about eight feet in height. One side of the opening is three or four feet higher than the other, and one should move carefully, to avoid stepping into the chasm before seeing it.

Reports of the Councillors.

Improvements.

By Wilbur B. Parker.

Read April 9, 1879.

At first thought many would consider the department of Improvements the least interesting branch of the work of our Club, requiring principally, as it does, the labor of the woodsman rather than the skill of the engineer or the taste of the artist; but on second thoughts we shall see that it more generally concerns our own members as well as the public at large than any other. A few only are fitted by education or natural taste for the scientific investigations that are the most important objects of our society, but all may appreciate at a glance the benefits of better paths to difficult summits, sheltered camps for passing the night, and clearings which render accessible new points of view or objects of special interest. Much assistance may be given in it too by every member of the Club; either by

actual labor in the woods (a pleasant and healthy exercise), by interesting residents among the mountains in the work, or last but not least, by pecuniary contributions to meet the necessary expenses.

Coming into this department as your present Councillor does with very little either of theoretical knowledge or actual experience in the work he has undertaken, but with an earnest desire to serve you to the best of his ability, he relies confidently upon your hearty coöperation in whatever enterprise we may undertake.

Among improvements most desirable to be accomplished the coming season may be mentioned: —

1. The carrying out of the plan for a path from Livermore Mills throu h to Waterville, with a branch to the summit of Mt. Carrigain.

This work is already contracted for with Mr. W. M. Sargent, the necessary funds having been subscribed by members of the American Institute of Instruction at the field-meeting held at Fabyan's last July. It is hoped it will be completed early enough for the summer travel.

2. The renewal of an old path between Waterville and the end of the No. Sandwich carriage-road at the foot of Mt. Whiteface, a continuation, as it were, of the Livermore Waterville Path. It is about twelve kilometers in length. Horses, and, I believe, even wagons used to pass through, and it is still frequently used by people who go in there trapping and gunning.

3. A path from Woodstock to the foot of Moosilauke is one of the most desirable to be built. It would be about twelve or thirteen kilometers in length, as near as I can judge from Mr. Henck's excellent map, and would save many miles of travel to those visiting this point from the Profile House and West Campton as well as Woodstock.[1]

4. There is a good path from the house of Mr. Marcus Knox (on the Conway side), to the summit of Mt. Chocorua, which only needs a little bushing out, measuring, and mark-

[1] Since writing the above the recent construction of this path by other hands has been reported, and it is even proposed to build a stage road by the same route.

ing with signs to make it a very convenient and pleasant way for people coming from that direction to ascend this grand mountain. It would save them a ride or walk of several miles.

5. The finishing and marking of a continuation of the Moat Path from the North to the South Peak, where it will meet a path on the south side of the latter. Messrs. Wm. L. and Chas. P. Worcester commenced this work last summer and will finish it this season.

The path on the South Peak is now rather difficult to find, but could easily be bushed out a little, and well marked. It would then be a delightful round trip from Conway up one peak and down the other.

6. Another locality needing a small amount of work is the path over Mt. Bartlett to the summit of Kearsarge. Signs are the principal things needed here. The Messrs. Worcester also undertake this duty.

7. A good path has long been needed from Crystal Cascade to the snow arch in Tuckerman's Ravine. There is said to have been one once upon a time, but I have scrambled through two or three times without ever having been able to discover it, except for a short distance above the cascade; owing probably to its not having been made wide enough to prevent its quickly growing over. It ought to be made at least three meters wide. The best way of getting to the head of the ravine and the summit of Washington should also be determined, and unmistakably marked with signs and cairns.

In connection with this work the path from the Mt. Washington carriage road, with which it will connect, ought to be well-marked, especially the entrance from the carriage-road.

The snow arch is one of the greatest curiosities of the White Mountains. But heretofore few have been able to enjoy it on account of the difficulty of reaching it. A good camp ought to be made there, that would enable parties to enjoy the late afternoon lights, and to climb to the top of Washington in season to see the sun rise.

In regard to the records, it seems desirable to make some improvement on the glass bottle thus far used. The paper, too, is

not large enough and is inconvenient, as a strip must be all unrolled in order to see the first record, a matter of some difficulty in a high wind; then, too, the cork contracts, letting in water, which spoils the records; and, worse than all, the bottle is often found broken.

It is proposed to substitute a round brass box, with a cover fitted with rubber packing and fastened on with a screw and clamp. The paper is made up into the form of a book, which has a surface of sixty-five feet in length, and would hold a thousand names. It could be made twice that size, if necessary. The old record should be folded up, and transferred to the box. I would also recommend that a similar box for matches be placed in each of the camps.

It is necessary that the paths should be well indicated. Cairns are the best and most convenient marks for the ledges above the woods. In the woods, where there are so many logging roads and paths branching off to perplex travellers, boards painted white, with plain black letters, can be seen best. To enable members to mark signs easily, a set of stencils has been procured which will be sent by mail to any address, on application to the Councillor of Improvements.

I have confined myself to-day to speaking of plans that one can reasonably hope to carry out the coming season; but there is a wide field to work in, and with larger means a great many other valuable improvements might be attempted.

APPENDIX. BY W. G. NOWELL.

Having been unable to present his autumn report for 1878 at the usual time, your former Councillor wishes to place on record at this time a few notes of the work accomplished in his department during the last summer.

1. A path was opened in July by Mr. Charles E. Lowe to the summit of Mt. Willey, N. H., following a route recommended by Mr. J. B. Henck, Jr., and marked out by Mr. Lowe with his assistance and that of Mr. Walter Jenney. The path was afterward measured, and marked in a temporary manner, by Messrs. E. C. Pickering, S. H. Scudder, H. C. Francis, W. Jenney, and J. B. Henck, Jr. The path leaves the Portland and Ogdensburg R. R., about 200 meters south of Willey Station. For 700m. it rises rapidly through the woods, then for 100m. more gradually, until it strikes the Brook Kedron. From this point the brook is followed for a distance of one kilometer to its source, whence a path through the woods

670m. leads to the summit. The whole path is 2471m. (1½ miles) long and in that distance it rises about 825m. (2700ft.), so that the average grade is about one in three. Water is found at a spring just across the track from the station and again where the path follows the brook.

2. A path was opened in August by Miss M. F. Whitman and Mr. A. E. Scott from " Camp Three Oaks," near Artist's Falls, North Conway, N. H., to the summit of Middle Mt. The path is 2620m. (1⅝ miles) long, 2310m. of the way being through the woods and the remainder over bare ledges. Water is found at the start, and at a brook crossed 1340m. (4400ft.) up the path and then followed for 610m. (2000ft.) farther. The path is well cleared, and marked by signs nailed to the trees in the woods, and by cairns on the ledges.

3. Record bottles were placed on the summit of Mt. Carrigain by Mr. S. E. D. Currier, and on a lower portion of the same mountain by Prof. E. C. Pickering. One was carried also to the summit of Mt. Willey, but the bottle being broken, the record was left in a tin can containing some previous records.

The Mt. Willey path was paid for by money raised by the Committee of Ways and Means, and the same committee interested the members of the American Institute of Instruction in the work of the Club to the extent of securing a subscription of $90 with which paths from Livermore to Waterville, and to the summit of Mt. Carrigain, will be constructed.

By-Laws of the Corporation.

ARTICLE I. The Corporation shall be called the APPALACHIAN MOUNTAIN CLUB.

ART. II. The objects of the Club are to explore the mountains of New England and the adjacent regions, both for scientific and artistic purposes; and, in general, to cultivate an interest in geographical studies.

[The foregoing articles, forming a part of the Agreement of Association, can be changed only by Act of Legislature.]

ART. III. Elections to membership shall be made by ballot, and the candidates may be voted for on one ballot; the affirmative votes of at least two-thirds of the members present and voting shall be necessary to election. Nominations shall be made in writing by at least two members, and forwarded to the Council through the Secretary. Should the Council approve the nomination, the Secretary shall announce the candidature at the next regular meeting of the Club, and balloting shall take place at the succeeding regular meeting. Each candidate elected shall pay an admission fee of two dollars, and subscribe assent to these By-Laws within six months after the election, otherwise the election of such candidate shall be void.

ART. IV. The officers of the Club shall be a President, Vice-President, Secretary, Treasurer, and five Councillors. These officers shall form a governing board to be termed the Council.

ART. V. The officers shall be chosen by ballot at the annual meeting, may be voted for on one ballot, and shall hold their offices until the next succeeding annual meeting, and until their successors are chosen in their stead; but any vacancy may be filled by a new election in the same manner, at any regular meeting, five days notice of the election having been given by the Secretary. The President and Vice-President shall not be eligible for two consecutive years, nor the Councillors for more than three consecutive years in the same department.

ART. VI. The President, or in his absence the Vice-President, shall preside at all meetings of the Club and Council; and, at the annual meeting, the President shall deliver an address upon some appropriate subject.

ART. VII. The Secretary shall conduct the official correspondence, give notice to members of the time and place of meetings, keep a record of the proceedings of the Club and Council, have charge of the library, pictures, documents, muniments of title, and the corporate seal, and present, at the annual meeting, a history of the Club during the previous year.

ART. VIII. The Treasurer, under the direction of the Council, shall collect, take charge of, and disburse all funds belonging to the Club, keep proper books of account, and, at the annual meeting, and at other times when required by the Club, present a report of its financial condition.

ART. IX. All official notices by the Secretary and Treasurer shall be given personally, or by mail, according to their best knowledge of the post-office addresses of the members.

ART. X. The five Councillors shall be chosen to represent, severally, the departments of Natural History, Topography, Art, Exploration, and Improvements. It shall be their duty to offer to the Council each spring a plan for the summer's work, and, at the November meeting, to report to the Club the work accomplished in their respective departments during the preceding summer. The Councillors are authorized, when they think it expedient, to call special meetings of those interested in their respective subjects, at which they shall act as Chairmen.

ART. XI. The Council shall be the managing board of the Club, control all expenditures, make rules for the use of its property, and act for its interests in any way not inconsistent with these By-Laws; but shall have no power to subject the corporation to any liability beyond the amount of the corporate funds.

ART. XII. Regular meetings of the Club shall be held on the afternoon of the second Wednesday of every month excepting July, August, and September, and field meetings at such times and places as the Council shall determine. The January meeting shall be the annual meeting. Eleven members shall form a quorum for business.

ART. XIII. Each member shall be subject to an annual assessment of two dollars, due at the annual meeting; but no assessment other than the admission fee shall be required of any member during the six months succeeding his election. Members whose assessments are six months in arrears shall have notice of the fact sent to them by the Treasurer. Members who shall have neglected to pay an assessment for more than one year, and who shall continue such neglect for more than one month after notice referring to this article

shall have been sent to them by the Treasurer, shall thereupon cease to be members, which fact, in each case, shall be certified in writing by the Treasurer to the Secretary, who shall enter it of record; but such membership may be revived by the Council in its discretion, upon payment of past dues. The President and Treasurer are authorized to remit any fee, *sub silentio*, when they deem it advisable.

Art. XIV. Any person elected to membership in the Corporation may become a life member upon payment of thirty dollars, and shall thereafter be subject to no fees or assessments of any kind. All moneys so received, together with such other sums as may be received or appropriated for permanent investment, shall be securely and separately invested by the Treasurer, as a Permanent Fund, the income only of which shall be expended.

Art. XV. The Club may elect Corresponding Members in the manner prescribed for the election of members of the Corporation, excepting that the Council only shall nominate; and from among the Corresponding Members it may elect in the same manner Honorary Members, not to exceed twenty-five in number; but Corresponding and Honorary Members shall not be (technically) members of the Corporation, nor be subject to any fees or liabilities whatever.

Art. XVI. These By-Laws are fundamental, and shall not be altered, amended, suspended, or repealed, in the whole or in part except by a vote to that effect of at least three-fourths of the members present and voting at two consecutive regular meetings of the Club, notice of the proposed change having been sent to all the members by the Secretary.

Officers for 1879.

President,
Prof. WILLIAM H. NILES, Cambridge, Mass.
Vice-President,
Rev. JOHN WORCESTER, Newtonville, Mass.
Secretary,
J. B. HENCK, JR., Mass. Inst. of Technology, Boston.
Treasurer,
Col. CHARLES W. FOLSOM, Cambridge, Mass.

COUNCILLORS:

Natural History, Prof. J. H. HUNTINGTON, Box 1914 Boston, Mass.
Topography, J. RAYNER EDMANDS, 46 Federal St., Boston, Mass.
Art, Mrs. PHEBE M. KENDALL, 123 Inman St., Cambridgeport, Mass.
Exploration, Prof. CHARLES E. FAY, College Hill, Mass.
Improvements, Dr. W. B. PARKER, 12 Beacon St., Boston, Mass.

Members of the Corporation.

June 25, 1879.

Addey, Markinfield, New York.
Agassiz, Alex., Cambridge, Mass.
Alden, Miss A. Fanny, Boston, Mass.
Allen, J. A., Cambridge, Mass.
Alvord, Henry E., Easthampton, Mass.
Ames, Charles H., Boston, Mass.
Anthony, Gardner C., Providence, R. I.
Appleton, Miss Grace P., Roxbury, Mass.
Atkins, Edwin F., Boston, Mass.
Atwater, W. O., Middletown, Conn.
Bacon, Francis M., New York.
Bacon, Francis M., Jr., New York.
Bacon, John W., Natick, Mass.
Bailey, William W., Providence, R. I.
Baker, Miss Ellen J., Boston, Mass.
Balch, Edwin S., Philadelphia, Pa.
Barr, Miss Ellen M., South Boston, Mass.
Bartlett, Willard, New York.
Benton, E. R., Brookline, Mass.
Bicknell, Thomas W., Boston, Mass.
Blanchard, Joseph N., New York.
Blatchford, John S., Boston, Mass.
Boutelle, Charles O., U. S. Coast Survey, Norfolk, Va.
Brown, Miss Louisa J., Cambridge, Mass.
Bumstead, N. Willis, Boston, Mass.
Burbank, L. S., Woburn, Mass.
Burgess, Edward, Boston, Mass.
Burton, H. J., Jr., Boston, Mass.

Carret, James R., Boston, Mass.
Caryl, Miss Harriet E., Boston, Ms.
Chase, R. Stuart, Haverhill, Mass.
Cheney, Miss Margaret S., Jamaica Plain, Mass.
Clarke, F. W., Cincinnati, Ohio.
Cogswell, P. B., Concord, N. H.
Cook, Eugene B., Hoboken, N. J.
Covill, William J., So. Boston, Mass.
Crawford, Geo. T., Livermore, N. H.
Crawford, Gilbert H., New York.
Crosby, W. O., Boston, Mass.
Cross, Chas. R., Boston, Mass.
Cross, Mrs. Chas. R., Boston, Mass.
Cummings, John, Boston, Mass.
Currier, S. E. D., Boston, Mass.
Curtis, Henry P., Boston, Mass.
Curtis, Rest F., Jamaica Plain, Mass.
Cutting, Hiram A., Lunenburgh, Vt.
Davis, Wm. M., Jr., Cambridge, Ms.
Denniston, A. C., Philadelphia, Pa.
Diller, J. Silas, Cambridge, Mass.
Dimmock, George, Cambridge, Mass.
Doane, Mrs. Clara J., Boston, Mass.
Dole, Nathan Haskell, Boston, Mass.
Dunham, Charles H., Boston, Mass.
Dunning, Mrs. Wm. H., Cambridge, Mass.
Eastman, Edson C., Concord, N. H.
Eastman, Samuel C., " " "
Edmands, Miss Elizabeth R., Salem, Mass.
Edmands, J. Rayner, Boston, Mass.
Ellis, Mrs. Grace A., Boston, Mass.
Emerson, Ben K., Amherst, Mass.
Emerson, Charles F., Hanover, N.H.
Emerton, J. H., Salem, Mass.
Emery, George E., Lynn, Mass.
Evans, Alfred R., Gorham, N. H.
Fay, Chas. E., College Hill, Mass.
Fenollosa, E. F., Salem, Mass.
Fenollosa, William S., Boston, Mass.
Folsom, Chas. W., Cambridge, Mass.
Folsom, Mrs. S. Sarah, Cambridge, Mass.
Francis, H. C., Philadelphia, Pa.
Gamble, James H., N. Conway, N.H.
Gardiner, Frederic, Jr., Cambridge, Mass.
Goodrich, Arthur L., Salem, Mass.
Graves, A. R., Littleton, N. H.
Gray, Francis C., Boston, Mass.
Greenleaf, Robert W., Cambridge, Mass.
Greenough, Mrs. Louisa I., Boston, Mass.
Guild, Chester, Boston, Mass.
Hagar, Eugene B., Boston, Mass.
Hale, Arthur, Cambridge, Mass.
Hale, Geo. S., Boston, Mass.
Hale, Miss Susan, Boston, Mass.
Hamlin, Chas. E., Cambridge, Mass.
Hammond, George F., Boston.
Hardy, A. S., Hanover, N. H.
Hasbrouck, J. Howard, Boston, Mass.
Hayes, S. Dana, Boston, Mass.
Haynes, Henry W., Boston, Mass.
Henck, John B., Boston, Mass.
Henck, J. B., Jr., Boston, Mass.
Hitchcock, C. H., Hanover, N. H.
Holden, Luther L., Boston, Mass.
Hollingsworth, Sumner, So. Braintree, Mass.
Holman, Silas W., Framingham, Mass.
Hopkins, Sylvanus C., Boston, Mass.
Hunt, T. Sterry, Montreal, P. Q.
Huntington, J. H., Boston, Mass.
Hyatt, Alpheus, Boston, Mass.
Iasigi, A. W., " "
Inches, Geo. B., " "
Ingalls, Miss Maria A., Dedham, Mass.
James, Thos. P., Cambridge, Mass.
Jenks, Charles W., Boston, Mass.
Jenney, Walter, South Boston, Mass.
Jones, Gardner M., Boston, Mass.
Jones, R. Ralston, Keokuk, Iowa.
Judson, Oliver A., Philada., Pa.
Keith, Herbert F., Grafton, Mass.
Kendall, Joshua, Cambridge, Mass.
Kendall, Mrs. Joshua, Cambridge, Mass.
Kennard, Chas. W., Boston, Mass.

Kennedy, George G., Roxbury, Mass.
Kingman, A. A., Brookline, Mass.
Kingman, Mrs. A. A., " "
Kinney, Abbot, New York.
Knapp, Arthur M., Boston, Mass.
Knowles, Miss M. A., Boston, Mass.
Ladd, Wm. H., Boston, Mass.
Lamson, C. D., Boston, Mass.
Lanza, Gaetano, Boston, Mass.
Lincoln, Mrs. M. L., College Hill, Mass.
Little, Wm., Manchester, N. H.
Littlehale, Miss Mary F., Boston, Mass.
Loring, Miss Fanny L., Brookline, Mass.
Lowe, Chas. E., Randolph, N. H.
Mackintosh, Miss Sarah B., Boston, Mass.
Mann, B. Pickman, Cambridge, Mass.
McEntee, Jervis, Rondout, N. Y.
McKaye, Mrs. M. E., Cambridge, Mass.
Merrill, Geo. N., Littleton, N. H.
Merriman, Daniel, Worcester, Mass.
Mitchell, Miss Maria, Poughkeepsie, N. Y.
Morrison, W. A., Cambridge, Mass.
Morrison, Mrs. W. A., " "
Morse, Edward S., Salem, Mass.
Morse, Geo. F., Portland, Maine.
Murdoch, John, Roxbury, Mass.
Niles, Wm. H., Cambridge, Mass.
Norcross, S. G., North Conway, N. H.
Nowell, Wm. G., Weymouth, Mass.
Noyes, Miss Margaret, Boston, Mass.
Olmsted, Miss Helen G., Boston, Mass.
Page, Miss Edith, Boston, Mass.
Page, Hollis B., Boston, Mass.
Palmer, Frederic N., Boston, Mass.
Parker, Charles W., Boston, Mass.
Parker, Miss Mary, " "
Parker, Henry A., No.Conway, N.H.
Parker, Wilbur B., Boston, Mass.
Pickering, E. C., Cambridge, Mass.
Pickering, Mrs. E. C., Cambridge, Mass.
Pickering, W. H., Boston, Mass.
Pickman, Dudley L., " "
Pierce, Frank A., Boston, Mass.
Pollock, Charles, " "
Porter, E. G., Lexington, Mass.
Pourtales, L. F., Cambridge, Mass.
Prentiss, Mrs. H. E., Bangor, Me.
Putnam, F. W., Cambridge, Mass.
Pychowska, Mrs. Lucia D., Hoboken, N. J.
Quimby, E. T., Hanover, N. H.
Rand, Edw. A., So. Boston, Mass.
Read, William, Boston, Mass.
Rice, H. M., Providence, R. I.
Richards, C. A. L., Providence, R. I.
Ridler, C. E., Kingston, Mass.
Robinson, Miss Frances M., Lexington, Mass.
Rogers, Wm. B., Boston, Mass.
Rollins, Wm. Herbert, Boston, Mass.
Sabine, George K., Brookline, Mass.
Saunders, Charles G., Lawrence, Mass.
Saxton, Samuel W., New York.
Saxton, Mrs. S. W., "
Schouler, James, Boston, Mass.
Schouler, Mrs. James, Boston, Mass.
Scott, Augustus E., Lexington, Mass.
Scudder, Samuel H., Cambridge, Mass.
Sears, Miss Ellen V., Boston, Mass.
Sheppard, Samuel A. D., Boston, Mass.
Short, Miss Mary L., New York.
Smith, W. B. T., Woodsville, N. H.
Spaulding, Henry G., Dorchester, Mass.
Sparks, Mrs. Jared, Cambridge, Mass.
Stafford, F. I., Newfoundland.
Starr, Theodore, Philadelphia, Pa.
Stone, Charles W., Boston.
Strong, Geo. A., New Bedford, Mass.
Sweetser, M. F., Boston, Mass.
Tallman, Henry C., New York.

Thayer, S. Proctor, North Adams, Mass.
Thompson, Leonard, Jr., Woburn, Mass.
Tilden, Miss Maria D., Boston, Mass.
Tillson, Henry F., Boston, Mass.
Tuttle, C. W., Boston, Mass.
Upham, Warren, Nashua, N. H.
Vogl, Mrs. Susie C., Boston, Mass.
Walker, C. Howard, Boston, Mass.
Walling, H. F., Boston, Mass.
Wellington, Chas. A., Boston, Mass.
Wells, Samuel, Boston, Mass.
Wells, Webster, Boston, Mass.
Wentworth, M. C., Jackson, N. H.
Whitaker, Channing, Boston, Mass.
Whitaker, Mrs. Channing, Boston, Mass.
Whitman, Miss M. F., Boston.
Whitman, Edmund B., Cambridge, Mass.
Whitney, Solon F., Waterto'n, Mass.
Whitridge, R. B., Boston, Mass.
Wilkinson, Mrs. Arthur, Cambridge, Mass.
Williams, Francis H., Boston, Mass.
Wilson, Edward L., Philadelphia, Pa.
Wilson, J. M., Charlestown, Mass.
Winslow, Saml. W., Boston, Mass.
Wolcott, Mrs. H. L. T., Boston, Mass.
Worcester, John, Newtonville, Mass.
Worcester, Mrs. John, Newtonville, Mass.
Worcester, Wm. L., Cambridge, Mass.
Worthen, T. W. D., Hanover, N. H.
Wright, T. F., Bridgewater, Mass.

HONORARY MEMBERS.

Daly, Charles P., New York.
Dana, James D., New Haven, Conn.
Guyot, Arnold, Princeton, N. J.
Hall, James, Albany, N. Y.
Malte-Brun, Victor Adolphe, Paris, France.
Rawlinson, Sir Henry, London, England.
Selwyn, A. R. C., Montreal, P. Q., Canada.
Tuckerman, Edward, Amherst, Mass.
Tyndall, John, London, England.

CORRESPONDING MEMBERS.

Blake, Wm. P., New Haven, Conn.
Brewer, Wm. H., " "
Chickering, J. W., Jr., Washington, D. C.
Comstock, C. B., Detroit, Mich.
Dall, Wm. H., Washington, D. C.
Dawson, Geo. M., Montreal, P. Q.
Dietrichson, N. G., Kristiania, Norway.
Emmons, S. F., Boston, Mass.
Gilman, D. C., Baltimore, Md.
Gardner, James T., Albany, N. Y.
Hayden, F. V., Washington, D. C.
Hilgard, J. E., Washington, D. C.
Houston, E. J., Philadelphia, Pa.
Humphreys, A.A., Washington, D.C.
King, Clarence, New York.
Lakes, Arthur, Golden, Colorado.
Lamborn, R. H., Colorado Springs, Colorado.
Lesley, J. P., Philadelphia, Pa.
Marcou, Jules, Salins, France.
Marsh, O. C., New Haven, Conn.
Meigs, M. C., Washington, D. C.
Murray, Alex., St. John's, Newfoundland.
Packard, A. S., Jr., Providence, R. I.
Saussure, Henri de, Geneva, Switzerland.
Stevenson, J. J., New York.
Tuttle, Albert H., Columbus, Ohio.
Warren, G. K., Newport, R. I.
Wheeler, Geo. M., Washington, D. C.

Proceedings of the Club.

February 13, 1878.—Nineteenth Regular Meeting.

President Fay in the chair.

Mr. Samuel H. Scudder, for the committee on incorporation, made a report recommending that the Club organize as a corporation, detailing the steps necessary to be taken, and suggesting some necessary changes in the Constitution of the Club.

On motion of Mr. Worcester the report was accepted and the recommendation adopted.

On motion of Mr. Scudder the amendment of the Constitution was referred to the committee, with the addition of Mr. S. E. D. Currier.

Mr. C. W. Folsom, for the committee on organization of sections, made a report recommending that such sections be formed, and that to this end a circular be sent to each member, requesting him to specify the department or departments in which he was willing to assist, these specifications, when received, to be referred to the Council, which should then direct the action to be taken by the several departments.

The report was accepted and the recommendations adopted.

Rev. J. C. Adams, of Newtonville, read a paper describing several trips among the hills of Mt. Desert Island, Maine.

Prof. J. H. Huntington read a paper on Roan Mt., North Carolina.

Mr. J. Rayner Edmands presented by title a paper on the White Mts. as seen from Mt. Monadnock.

March 13, 1878.—Twentieth Regular Meeting.

President Fay in the chair.

Prof. Edward S. Morse described a mountain excursion in Japan.

A recess was then taken to allow the organization of the Club as a corporation.

This organization having been effected, the original meeting was called to order again, and the following resolution passed.

Resolved: That the officers severally, and the Council, be hereby authorized and instructed to effect such assignment and delivery to the Appalachian Mountain Club, a corporation duly established by law, and having its location in Boston, within the Commonwealth of Massachusetts, of all the records, documents, muniments of title, moneys, credits, books, and other property of every kind and description, belonging to this unincorporated Club, as will vest in said Corporation the full legal and equitable title thereto.

April 10, 1878.—Twenty-first Regular Meeting.

President Fay in the chair.

The resolution adopted at the last meeting, as being of the nature of an amendment to the Constitution, was submitted to a second vote, and again passed.

January 8, 1879.—Twenty-second Meeting.

President Fay in the chair.

On motion of Mr. Currier, the following resolution was passed:—

Resolved: That this voluntary, unincorporated association, heretofore known by the name of the Appalachian Mountain Club, be, and the same is, hereby dissolved.

March 13, 1878. First Meeting of the Corporation.

The meeting was called to order by J. B. Henck, Jr., who read the call for the meeting.

Prof. Wm. H. Niles was then elected and sworn as Temporary Clerk.

The following votes were then passed:—

Voted: That those now recorded on the books of the Association heretofore known as the Appalachian Mountain Club, as active members, be members of this Corporation; provided that within six months they shall have accepted such membership by signing the By-Laws.

Voted: That those who have been elected active members of the Association heretofore known as the Appalachian Mountain Club, but who, not having fulfilled all the requirements of the Constitution, are not yet enrolled as members of the same, shall become members of this Corporation upon signing the By-Laws and paying the admission fee within six months.

Voted: That those now recorded on the books of the Association heretofore known as the Appalachian Mountain Club, as corresponding and honorary members, shall retain the same title in relation to this Corporation, but they shall not be (technically) members of the Corporation, nor be subject to any fees or liabilities whatever.

By-laws were then adopted, being as printed on page 81, with the addition to Article XIII of the words "Commutation may be purchased for thirty dollars," and the omission of Art. XIV, the numbers of the following articles then standing as XIV and XV instead of XV and XVI.

The officers of the original association were then elected as officers of the Corporation (see vol. I. p. 300).

President Fay then took the chair, and a certificate notifying the agreement of association, and the holding of a first meeting of the subscribers thereto was signed and sworn to by a majority of the officers-elect of the Corporation.

The meeting then adjourned.

April 4, 1878. — Special Meeting.

President Fay in the chair.

Prof. H. F. Walling read a paper on Some Recent Views Concerning Mountain Structure.

The subject was discussed by Profs. Benjamin Peirce and W. H. Niles.

April 10, 1878.—Second Corporate Meeting.

President Fay in the chair.

On motion of Mr. Currier it was voted that until otherwise ordered the candidates for membership at any election shall be voted for on one ballot.

The President spoke of the need of funds to carry on the work of the Club, and recommended the appointment of a Committee of Ways and Means.

It was voted that the chair appoint a committee of five, and Mr. Scudder, Mr. Folsom, Mrs. Sparks, Capt. Fox, and Mrs. Kendall were appointed.

At the request of its chairman, Prof. Pickering, the Committee on Nomenclature was authorized to add to its number.

Mr. S. H. Scudder read a paper by Prof. Arthur Lakes, describing an ascent of Long's Peak, Colorado.

Prof. C. R. Cross read a paper by Prof. F. W. Clarke on some barometric measurements of heights among the White Mountains.

Prof. W. H. Niles read a paper on Zones of Physical Features on Mountain Slopes.

May 8, 1878.—Third Corporate Meeting.

President Fay in the chair.

On motion of Prof. Niles the Committee of Ways and Means was authorized to act for the Club in raising funds.

Prof. C. E. Hamlin read a paper on Mt. Katahdin, Maine, illustrated by a map of the surrounding region and a model of the mountain.

Prof. W. H. Niles presented his report as Councillor of Natural History.

Prof. J. H. Huntington presented his report as Councillor of Exploration.

Mr. W. G. Nowell presented his report as Councillor of Improvements.

June 12, 1878.—Fourth Corporate Meeting.

President Fay in the chair.

The President announced the death of an honorary member of the Club, Prof. Joseph Henry.

The President for the Committee of Ways and Means, asked the coöperation of members of the Club in raising funds for the prosecution of its work. He spoke of several circulars which were to be issued, and which

would be sent to any members who would use them in soliciting subscriptions.

Prof. H. F. Walling showed a model in wax which he had prepared to illustrate the theory of mountain upheaval which he had advanced in a paper recently read before the Club.

Mr. C. W. Folsom showed two sets of Appalachia which he had had bound for presentation to the Crawford and Fabyan Houses, and it was voted that they be officially presented to the said hotels, with the request that they keep them in their respective libraries, or otherwise, for the use of their guests.

Mr. J. R. Edmands showed some camera profiles which he had recently finished for publication in Prof. Hitchcock's "Geology of New Hampshire" (republished with this number, see p. 59).

Mr. J. R. Edmands presented his report as Councillor of Topography.

Rev. John Worcester presented his report as Councillor of Art. He also read a letter from Mr. Edmands offering the use of his original camera to the department of Art, and making some suggestions as to its use.

Mr. W. H. Pickering read a paper describing several new points of interest near Campton, N. H. (See p. 75.)

Miss M. F. Whitman read a paper describing some experiences on Moat Mt., North Conway, N. H.

July 10, 1878.—Fifth Field Meeting.

Held at the Fabyan House, White Mts., N. H.

President Fay in the chair.

The President made some introductory remarks, describing the nature and purposes of the Club.

Mr. S. H. Scudder spoke of the insects of high altitudes among the White Mts.

Prof. E. T. Quimby described the work of the U. S. Geodetic Connection Survey under his charge.

Miss M. F. Whitman read a paper on Camp Life for Ladies. (See p. 44).

Prof. C. H. Hitchcock exhibited his model of the White Mts., and described some recent explorations made by him.

The Secretary described the new path to the summit of Mt. Willey.

Prof. E. C. Pickering and Mr. J. R. Edmands exhibited and described a number of instruments useful in mountain surveying.

A telegram from Mr. C. R. Milliken was read announcing the completion of a path to the summit of Mt. Madison from the east side.

On Thursday, July 11th, a party of about twenty ladies and gentlemen ascended Mt. Willey by the new path.

August 21, 1878. — Sixth Field Meeting.

Held at North Conway, N. H.

President Fay in the chair.

The President opened the meeting with some remarks on the nature and purposes of the Club, and announced the excursions to be made on Thursday and Friday.

The Secretary showed a portable heliotrope which Prof. Quimby had designed for use in his work among the mountains.

Rev. John Worcester read a paper on the Conway Valley.

Prof. E. C. Pickering showed a new instrument for measuring the relative clearness of the air.

Rev. Henry A. Parker read a paper on North Conway in Winter.

Prof. Pickering described a visit to the mountains in the Spring.

Mr. S. H. Scudder showed a knapsack of Prof. Morse's pattern, and described some improvements of his own design.

Mr. Scudder also spoke of the approach to the mountains by way of Sebago Lake and Mt. Pleasant.

Mr. A. E. Scott announced the completion of a path from "Camp Three Oaks" to the summit of Middle Mt., Conway, N. H.

The President gave a brief account of the paths thus far made under the auspices of the Club.

On Thursday, August 22, a party of ladies and gentlemen ascended Moat Mt. by the path opened last year.

On Friday, August 23, an excursion was made by special train to the Fabyan House, a party leaving the train at Livermore, and ascending Mt. Carrigain, a second party leaving the train at the Crawford House and ascending Mt. Willard, and a third party ascending Mt. Washington by rail from the Fabyan House.

October 9, 1878. — Fifth Corporate Meeting.

President Fay in the chair.

The President called attention to the course of lectures on Natural Scenery, to be given under the auspices of the Club by Prof. Niles.

Rev. H. G. Spaulding spoke of a paper in the Proceedings of the Connecticut Historical Society on Indian Etymology, and recommended that the Club try to secure the proceedings of the Society in exchange for Appalachia. The Secretary was instructed to open correspondence to that end.

Prof. W. H. Niles gave a brief account of the late Dr. Petermann, of Gotha, who was an honorary member of the Club.

Rev. H. G. Spaulding read a paper on Mt. Moosilauke and the Benton and Franconia Ranges. (See p. 28.)

Prof. J. H. Huntington read a paper on the Magalloway River.

Mr. Frederic Gardiner, Jr., read a paper on Mt. Ascutney, Vt.

November 13, 1878. — Sixth Corporate Meeting.

President Fay in the chair.

On motion of Prof. Huntington it was voted that members of the original association, and others who had failed to comply with the requirements of the votes passed at the meeting of March 13, 1878, be allowed an extension of the time to one month from date.

Mr. J. R. Edmands presented his report as Councillor of Topography.

Prof. J. H. Huntington presented his report as Councillor of Exploration.

Prof. E. T. Quimby read a paper on Sun Telegraphing, describing the use of the heliotrope for that purpose. (See p. 52.)

Mr. Edmands described a system of aids to sun telegraphing, designed to avoid the difficulty experienced by some persons in learning the Morse alphabet.

Prof. E. C. Pickering made some suggestions with regard to a code of signals to be used among the mountains or elsewhere, and moved the appointment of a committee to arrange and report such a code for the use of the Club. The motion was passed, and the chair appointed a committee consisting of Prof. E. C. Pickering, Mr. S. H. Scudder, and Mr. J. R. Edmands.

December 11, 1878. — Seventh Corporate Meeting.

President Fay in the chair.

Mr. S. H. Scudder moved the appointment of a committee to present nominations for the officers to be elected at the next meeting. The chair appointed Messrs. S. H. Scudder, George Dimmock, and R. F. Curtis.

Prof. W. H. Niles made a report as Councillor of Natural History.

Prof. H. F. Walling read a paper on Mt. Tobey, Mass., using this mountain as an illustration of the theory of mountain upheaval recently advanced by him.

Mr. W. H. Pickering read a paper describing an ascent of the Half Dome, in the Yosemite Valley, illustrated by views of the Valley and its special points of interest.

January 8, 1879. — Eighth Corporate Meeting.

President Fay in the chair.

It was proposed that the fees received for life membership be invested as a permanent fund, the interest only to be used for the expenses of the Club. On motion of Mr. Scudder the matter was referred to the Council.

On motion of Mr. Scudder a vote of thanks was tendered to the Mass.

Institute of Technology for the use of rooms and other conveniences during another year.

On motion of Mr. S. E. D. Currier it was voted that until otherwise ordered, the candidates for office at any election shall be voted for on one ballot.

The committee on nominations then reported candidates for the several offices of the Club, and the persons proposed were all elected. (See p. 84.)

President Fay then retired from the chair, in the absence of the President and Vice-President elect, asking Prof. E. C. Pickering to take his place.

The retiring President then delivered the annual address. (See p. 1.)

The Secretary and Treasurer then presented their annual reports. (See p. 61 and 64.)

On motion of Mr. Scudder, the report of the Treasurer was accepted, and a vote of thanks for his past services was passed.

On motion of Mr. C. W. Folsom, the portions of the President's Address and Secretary's Report relating to the publications of the Club, were referred to the Council, with the request for a report as to what action, if any, was advisable.

Mr. Frederick A. Ober then read a paper on An Ascent of the Souffrière of Guadaloupe (Forest and Stream, Jan. 23, 1879); after which he exhibited a number of views of points of interest in the Lesser Antilles.

On motion of Mr. Folsom, a vote of thanks was tendered him.

February 12, 1879. — Ninth Corporate Meeting.

President Niles in the chair.

The Council proposed the following amendments to the By-Laws: —

1. Omit the final sentence of Art. xiii, "Commutation may be purchased for thirty dollars."

2. Insert the following:

Art. xiv. Any person elected to membership in the Corporation may become a life member upon payment of thirty dollars, and shall thereafter be subject to no fees or assessments of any kind. All moneys so received, together with such other sums as may be received or appropriated for permanent investment, shall be securely and separately invested by the Treasurer, or by Trustees chosen annually for the purpose by the Club, as a Permanent Fund, the interest only of which shall be expended.

3. Change the numbers of Arts. xiv and xv respectively to Arts. xv and xvi.

Prof. E. C. Pickering moved that the amendments be passed to a second reading.

Mr. S. E. D. Currier moved to amend, by inserting the words "or income" after the word "interest."

Prof. C. E. Fay moved to amend Mr. Currier's amendment by omitting the words "interest or."

The amendment of Mr. Currier as amended was adopted.

Mr. Currier moved to further amend the proposed amendment by omitting the words "or by Trustees chosen annually for the purpose by the Club."

The amendment was adopted, and the proposed amendments as amended were passed to a second reading.

Mr. J. R. Edmands presented the report of the Council in the matter of obtaining subscriptions in aid of Appalachia, the report advising the opening of such a subscription at once.

On motion of Mr. Currier the report was accepted.

Rev. John Worcester moved that a committee of nine members with power to add to their number, be appointed by the chair, said committee to be charged with the work of soliciting such subscriptions at once.

The motion was passed, and the chair appointed Mr. S. H. Scudder, Mr. J. R. Edmands, Prof. C. E. Fay, Mr. C. W. Folsom, Mrs. Phebe M. Kendall, Miss Ellen J. Baker, Mr. R. F. Curtis, Mr. George B. Inches, and Mr. C. W. Kennard.

It was proposed that a further extension of time be granted to those members of the original association who had not as yet complied with the requirements of membership in the corporation.

On motion of Mr. Scudder the matter was referred to the Council with full powers.

Mr. J. R. Edmands then read a paper on the Identification of Distant Points, (see p. 34), with a description of Prof. Fernald's determination of the position of Mt. Katahdin, in Maine.

March 12, 1879.—Tenth Corporate Meeting.

President Niles in the chair.

In the absence of the Secretary Mr. J. R. Edmands was appointed Secretary, *pro tem.*

The Treasurer called attention to the benefit which would result from a more prompt payment of annual assessments by the members.

The amendments to the By-Laws passed at the last meeting were then read and passed the second time.

Mr. Geo. F. Hammond read a paper on the Practical Application of Mountain Sketching.

Mr. W. O. Crosby read a paper on the Pitch Lake of Trinidad.

A letter was read from Gen. G. K. Warren, asking the assistance of the Club in the naming of a bay on the south coast of Massachusetts. The matter was referred to the Council.

April 9, 1879.—Eleventh Corporate Meeting.

President Niles in the chair.

Mr. W. H. Pickering was appointed Secretary, *pro tem.*

Prof. J. H. Huntington presented his report as Councillor of Natural History. (See p. 65.)

Mrs. Phebe M. Kendall presented her report as Councillor of Art. (See p. 71.)

Prof. C. E. Fay presented his report as Councillor of Exploration. (See p. 72.)

Dr. W. B. Parker presented his report as Councillor of Improvements. (See p. 76.)

Prof. E. C. Pickering suggested that copies of the records made in the Club bottles be left on the mountains when the originals were removed.

Prof. Pickering then read the report of the Committee on Signals. (See p. 49.)

On motion of Prof. Fay the report was adopted, and it was voted that the code of signals recommended by the committee be printed for general distribution.

Prof. Fay read a paper by Prof. F. W. Clarke, describing a Trip to North Carolina. (See p. 14.)

Mr. M. F. Sweetser mentioned that a new edition of Osgood's White Mountain Guide Book was about to be issued, and asked the members of the Club to inform him of any errors which they might have found in the former edition.

On motion of Prof. Pickering the matter was referred to the Council to take such action as was possible in aid of the proposed revision.

May 14, 1879.—Twelfth Corporate Meeting.

President Niles in the chair.

Prof. J. H. Huntington read a paper entitled From the Forks of the Kennebec to Lake Megantic.

Mr. J. R. Edmands presented his report as Councillor of Topography. (See p. 68.)

President Niles made some remarks on the use of the Alpine-rope.

The President announced excursions to be made to Prospect Hill, Waltham, and to Mt. Wachusett. Also the probable time and place of a field meeting to be held in July.

May 17, 1879.—A party of about thirty-five ladies and gentlemen made an excursion to Prospect Hill, in Waltham, Mass.

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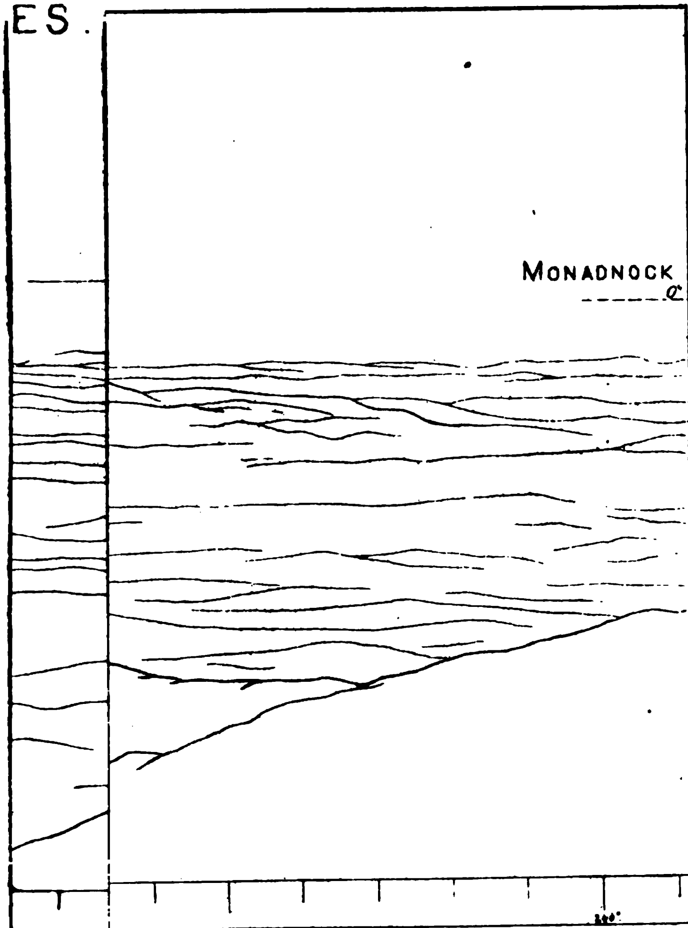
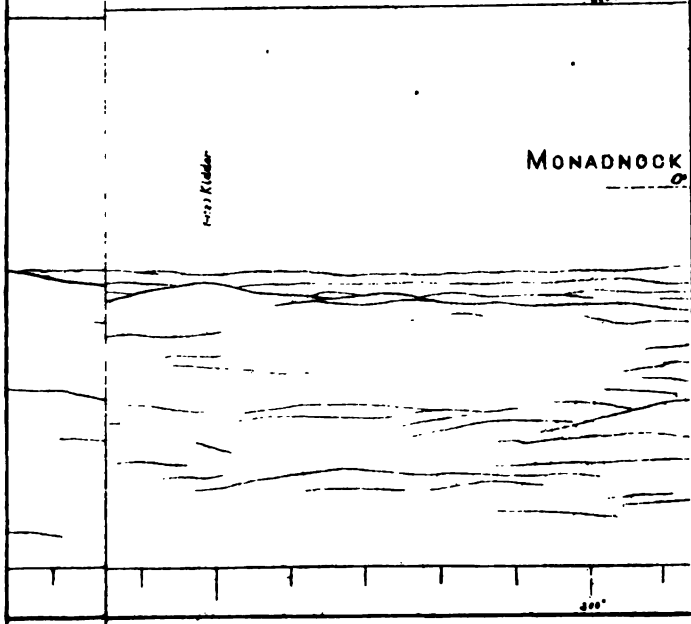




APPALACHIA.

VOL. II. BOSTON, JULY, 1880. No. 2.

On a New Map of the Catskill Mountains;

With Remarks on the Physical Geography and Hypsometry of that Region.

BY ARNOLD GUYOT.

Read December 10, 1879.

IT is well known to most of the members of the Appalachian Club, that ever since 1849 I have devoted the greater part of my summer vacations to the investigation of the physical structure of the Appalachian system, and to the measurement of its altitudes from New Hampshire to Georgia. The larger number of the results obtained, however, still await a full publication, which has thus far been prevented from the want of the necessary leisure for a final revision. A map of the culminating region of the Appalachian system in North Carolina and Georgia, in which I have located over 500 measured altitudes, is still in manuscript: a large number of carefully determined heights in the Adirondack region, with indications of the hypsometric distribution of the forest trees and characteristic plants, is in the same condition.

To-day I have the pleasure of sending to the Club a map of the Catskill Mountains, in which I have embodied the results of my investigations in that region during several summers.[1]

[1] By the courtesy of the publishers of the "American Journal of Science," we are able to print a reduced copy of this map, the plate for which was prepared for that Journal. See Plate III.

The map is drawn on the scale of three miles to the inch, and covers a surface of about 4,000 square miles, of which the mountainous part proper occupies somewhat more than one half, or about 2,400 miles. The hydrography is taken from the most recent county and township maps of Greene, Ulster, Delaware, and Schoharie Counties, and has been regulated by the positions of the mountains. The entire mountain system, which is all but absent, or erroneous in the county maps, has been located by means of a theodolite and a sextant, reading to a minute of a degree; using natural signals, and taking as a base the points of the triangulation of the Coast Survey along the Hudson River. The altitudes have been measured by mercurial barometers, with the aid of assistants all trained by myself; the aneroid was used in a few cases only.

The altitude of five points, in the east, south, centre, and west, has been determined with great care, from the Hudson River and the Ulster and Delaware Railroads; and each served as a base for the measurement of the neighboring heights.

The elevations are all reduced to the mean tide level in New York harbor, assuming this to be, according to the Coast Survey, about 2½ feet below mean tide level in Rondout and Catskill Creeks. This map gives, therefore, for the first time, I believe, a somewhat correct topography and hypsometry of that interesting mountain region. The mountain outlines on the borders have been selected from a very large number of profiles used in the construction of the map, in order to show the general character of the mountain chains and their indentations.

The Appalachian district to which the name of the Catskill Mountains is applied by the inhabitants, has no well-defined limits. Taking natural boundaries as a guide, it may be said to be contained between the Hudson on the east, the Catskill Creek on the north, the head-waters of the Susquehanna and Delaware on the north and west, and those of the Rondout Creek on the south. It is divided by the Esopus Creek into two groups, differing considerably in their topography and physical structure; the one on the north, situated mostly in Greene County, the Northern, or Catskills proper; the other on the south, in Ulster County, the Southern Catskills, or Shandaken Mountains.

Several features of the Catskill Mountain group are well calculated to excite curiosity, and to attract the special attention of the geographer and the geologist. It appears in the midst of the Appalachian system as an anomaly. While, in the latter, the chains of mountains stretch throughout in the direction of southwest to northeast, the ranges in the Catskills extend almost at right angles from the southeast to northwest, or east to west. Again, while the highest chains of the Appalachians in New Jersey do not reach, and in the Shawangunk rarely exceed 2,000 feet, the Catskills suddenly swell to the height of 3,500 and 4,000 feet, and overtop the surrounding plateaus by 2,000 feet, and even the regular chain of the Green Mountains on the other side of the Hudson valley, by 1,500 feet.

I have shown elsewhere, in the Appalachians of North Carolina and Georgia, the existence of transverse chains reaching 5,000 and 6,000 feet; but the two great border chains, the Smoky Mountains and the Blue Ridge, retain the normal direction, while in the Catskills even the two border chains run at right angles to it.

Before attempting to solve these difficulties, it seems best first to faithfully describe the characteristic physical structure of this geographical district. I begin with the northern group, the Catskills proper.

I. The *Northern Catskills*, between the Esopus and the Catskill Creeks, have the shape of an irregular parallelogram, extending from S. E. to N. W. and contained between two border chains running in about the same direction; one on the S. W., which we may call the Central chain of the Catskills, the other on the N. E. This square is closed on the S. E. by the short range of the High Peak and on the N. W. by the high swell of plateaus which divide the head-waters of the Delaware and Susquehanna from those of the Schoharie Creek and the Hudson. Inside of this highland, three secondary ranges, starting from the N. E. border chain, run westward to the Schoharie Creek, near the foot of the Central range, enclosing as many valleys, whose waters are tributaries of the Schoharie. The Eastkill and East Jewett, between the Eastkill and the main Schoharie; the Black Head range, and its continuation, the West Jewett range, between the Eastkill and Batavia Creek; the Pisgah range, between the Batavia and the Manorkill.

We may add the short range of the High Peak between the two head branches of the main Schoharie Creek, whose valleys find a continuation in the deep gorges known as the Kaaterskill and Plaaterkill Cloves.

1st. The *Central chain*, which forms the southern border of the Northern Catskills, is the longest and most characteristic; it also bears the highest summits of the group. Its first half runs W. N. W.; the second, N. W. It is broken by three deep gorges, or cloves, which divide it into four parts, each with a somewhat individual character. These gorges, which are the only great avenues from the south into the interior highlands, are, from east to west; the Stony Clove, 1,700 feet, celebrated for its wild scenery and its ice caves, reaching the Schoharie waters near Hunter village; the Deep Hollow, 1,973 feet, near Lexington; and the Grand Gorge, 1,570 feet, crossed by the Ulster and Delaware Railroad near Moresville.

The first division, eight miles long, begins by a horseshoe formed by the Overlook and the Plaaterkill Mountains, with an elevation of respectively 3,150 and 3,280 feet. It gradually rises (see the list of heights) in the Indian Head, Schoharie peaks, Mink Mt., and Stony Mt., whose maximum height reaches 3,844 feet. The second division, between Stony Clove and the Deep Hollow Gorge, nine miles long, is the culminating region of the central chain. It begins with Hunter Mt., the highest point of the Northern Catskills, 4,038 feet, whose broad mass sends a rocky spur to the north, the Colonel's Chair, 3,037 feet, and a still higher one to the south. From these two spurs, two parallel ranges, enclosing the deep Westkill valley, extend westward; the Westkill range, with the Big Westkill Mt., 3,896 feet, which is the true continuation of the central chain; and, on the north, the Lexington chain, reaching in the Evergreen Mt. an altitude of 3,624 feet. Beyond the Deep Hollow the central chain turns abruptly to the northwest, and its third division, eleven miles long, is again a single chain gradually losing in height, but which still shows in the Vlaie or Fly Mt., 3,531 feet, and in the Ontiora Mt., at the head of the Little Westkill, 3,458 feet. In the fourth division, from the Grand Gorge to Stamford, six miles long, the average elevation keeps above 3,000 feet, and the central chain terminates abruptly in

the Utsyantha Mt., 3,203 feet, with the same altitude at which it began in the Overlook.

2d. The *northeast border chain* is more irregular than the central chain. Though its general direction is from the southeast to northwest, it alternates several times between north, northwest, and west. The chain appears more like the edge of the interior highlands, falling towards the broad and low valley of the Catskill Creek, than a continuous range. Beginning in the South Mountain, near the Mountain House, with 2,497 feet, it terminates by a series of hills of 2,600 feet, which seem gradually to lose themselves in the northwestern plateaus. Like the central chain, it rises fast to its culminating point, Black Head, 3,945 feet, beyond which Windham High Peak, 3,534 feet, and Pisgah, 2,905 feet, show a more gradual decrease of altitudes. The slopes are abrupt on both sides, but reach the valleys in the interior at an altitude of 2,000 feet. The gaps in the chain are few, and are seldom below 2,000 feet.

3d. Between the two east ends of the main chains just described, and the two branches of the head-waters of the Schoharie Creek, rises the short chain of the High Peak, six miles long, which rises abruptly from the border of the lowlands of the Hudson valley to its maximum height in the High Peak, 3,664 feet, from which it descends to the Roundtop, 3,500 feet, and terminates in Clum Hill, 2,372 feet, near the confluence of the two branches of the Schoharie Creek. The first two of these points are the only ones in the Catskills, to my knowledge, of which old measurements have been made, but they have been found to be considerably in error. Three or four measurements I have made of the High Peak, in different years and different atmospheric circumstances, have varied but very little from each other, and give the altitude above indicated. It is to be remarked, however, that the High Peak of the present day is the old Roundtop of our geographies and atlases, which was proclaimed the highest peak of the Catskills, and to which the height of 3,804 feet was assigned; while the present Roundtop was named High Peak by the mountaineers because it appears from the interior to be the higher of the two. These various errors are easily understood. Nowhere do the Catskills appear more imposing than from the eastern lowlands

along the Hudson and the Catskill Creek valley. These undulating plains rise only very gradually, a distance of seven to eight miles, to the foot of the mountains, where their altitude seldom exceeds 600 feet. From this low base the mountains appear in their whole height, especially the High Peak, which stands isolated between the two deep gorges of the Kaaterskill and Plaaterkill. It was thus natural to look here for the highest peaks. Actual measurement, however, proved this to be an error, and forced us to restore to the interior peaks their pre-eminence, which was unsuspected even by the inhabitants living at their foot.

4th. Of the three *interior ranges* the central one, the Black Head range, is the most remarkable from its absolute elevation and its length. The eastern part of it, the Black Head range proper, is perhaps the most imposing of all the Catskills. It also bears the second highest peak of the northern group; the Black Dome, 4,003 feet. Its dark, wooded summits keep an altitude but little inferior; but soon it is interrupted by deep gaps, and its continuation in the West Jewett range does not rise higher than 3,025 feet, and 2,931 in the Tower Mountain. The third, or northern, range of Pisgah, contrary to the character of the others, begins with 2,905 feet in Pisgah, and rises in the Ashland Pinnacle to 3,420 feet, an altitude almost equal to that of the main chains.

Beyond, to the northwest, begins a region of plateaus which are seldom below 2,000 feet in altitude, while the undulating hills on their surface reach to a few hundred feet more.

Before leaving this mountain group, let me call the attention to some remarkable features of its hydrography. While the Northern Catskills group has for outside boundaries two deep valleys whose waters rise in the northwestern plateaus, and flow to the southeast, the interior highlands are drained only by the Schoharie Creek and its tributaries, thus forming a single hydrographic basin, whose waters rise on the extreme east within a few miles of them, and flow to the northwest and north to the Mohawk, and back again to the Hudson, following the opposite direction of the surrounding streams.

The anomaly of the direction of the chains of mountains of the Catskills, however, is only apparent. Throughout the

mountains, the valleys, and the plateaus, the strata are all but horizontal, or with dips rarely exceeding 4° to 5°. These chains, therefore, are no axes of upheaval; no anticlinals and synclinals, as in the ordinary chains of the Appalachians. They are simply scooped out of an original plateau by the erosive forces which have so long acted on them. I may explain elsewhere the probable cause of the peculiar drainage; it suffices here to say that the whole mass of that group belongs to the western plateau region of the Appalachian system.

II. *The Southern Catskills* have not the regular features which characterize the northern group; and their boundaries are not so well defined, except along the Esopus valley. The central mass, containing the most continuous and elevated chains, from which flow the head-waters of the Esopus on the north, and of Navesink and Rondout Creeks on the south, occupies the townships of Shandaken and Denning. It is flanked on the east by several high chains running north and south, in Olive, and on the west by long ridges, extending to the southwest and northwest into the Delaware Basin, in Hardenburg. This mountain tract, from the Esopus at Olive City to the Delaware near Margaretville, at the end of the Drybrook ridge, is twenty-five miles in extent; its width, from the Esopus at Shandaken to the southwestern boundary of Denning, is about sixteen miles.

There is here no interior plateau enclosed between high border-chains. The massive central chain, which bears the highest summit, is accessible from all the surrounding valleys without crossing any high pass; but the roughness of the wild mountain torrents and the unbroken primitive forest make that access anything but an easy task.

Though the direction of the main chain is about the same as in the Northern Catskills, viz. west-northwest and northwest, several important ridges run to the north and northeast, almost at right angles, a direction never found in the first group, and imparting considerable irregularity to the physical structure of the Southern Catskills.

The main chain, beginning with the Slide Mountain, stretches west 22° north for eight miles, to the knob of Eagle Mountain, from which it turns at right angles, north 30° east, four miles

to Balsam Mountain, and changes again, beyond the Lost Cove, to north 40° west in Belle Ayre, where it terminates. The first two parts form a dark, high, unbroken wall of twelve miles, densely wooded, crossed by a single wood road, in the Big Indian, or Helsinger Notch, 2,677 feet. Few summits rise higher than the general crest. They are, from east to west, the Slide Mountain, 4,205 feet, Hemlock Mountain, Sprucetop, 3,567 feet, Fir Mountain, about the same height, Eagle Mountain, 3,560 feet, Balsam Mountain, south end, 3,601 feet. Belle Ayre has a milder aspect, and descends to 3,394 feet in its highest portion.

The Slide Mountain, the culminating point of the Southern, and the highest of all the Catskills, is in many respects quite remarkable. It terminates abruptly on the northeast toward the deep valley of Woodland, or Snyder Hollow, showing signs of a slide of fallen rocks which suggested its name. From its broad triangular top it sends a ridge toward the southeast which divides the waters of the Esopus from those of the Rondout and terminates in the Lone Mountain, 3,690 feet, by which it is almost connected with the Wittemberg chain.

Another high ridge descends toward the south, and nearly reaches the high group of Table Mountain, 3,865 feet, and Peak-o'-Moose, 3,875 feet, which separates the head-waters of the Rondout from those of the east branch of the Navesink. The Slide thus becomes the main hydrographic centre of the region, sending its waters to the northwest by the Esopus; northeast, to the same, by the Woodland Creek; south, by the Rondout, to the Hudson; southwest, by the Navesink, to the Delaware.

At 500 feet from the top, steep ledges, suddenly breaking the evenness of the ridge, mark the base of the cap of hard subcarboniferous conglomerate (No. 10 of the First Pennsylvania Survey, according to James Hall), which crowns the king of the Catskills. An easy ascent is found by taking the road from Big Indian Station to the Helsinger Notch, from which the ridge just beyond the Navesink waters leads to the top by a regular and gentle slope.

On the east, several chains, not yet well studied, run from the neighborhood of the Slide between the Woodland Creek

and the middle course of the Esopus. The most important is the rough chain of the Wittembergs. The highest points are, from south to north, Cornell Mountain, 3,681 feet, near Lone Mountain and on the line of the Slide; Friday Mountain, and Great Wittemberg, 3,778 feet. Further to the east, and south of Shokan, High Point, celebrated for the beauty of its panorama, rises almost isolated from a low ridge to the altitude of 3,098 feet.

Between the Slide and Balsam range, on the south and west, and the Wittemberg chain, on the east, lies the central plateau of the Pantherkill, seven miles wide each way, wild and wooded, entirely surrounded by the waters of the Esopus and the Woodland Creek. It is surmounted by a long ridge running nearly due north from Slide Mountain, with two prominent peaks, the highest of which, the Pantherkill Mountain, rises to an altitude of 3,828 feet. It is deeply scooped out by torrents which pour their waters, on the east directly, and on the west by the Woodland Creek, into the Esopus.

On the southwest of the angle formed by the Fir and Eagle Mountains, but hardly connected with the main chain, rise two mountain peaks of still greater altitude, Graham Mountain, 3,886 feet, and Doubletop, 3,875 feet, called respectively, by the few settlers, South Mountain and Roundtop. My reason for changing these names was to avoid the confusion arising from their frequent repetition. These two high peaks, closely connected together, are situated, in regard to the main chain, as Table Mountain and Peak-o'-Moose are at the east end, south of the Slide; and both groups are of the same elevation. The Graham Mountain group is a remarkable hydrographic centre, sending many branches to the Delaware; the Drybrook and the Millbrook, to the north and west; the Beaverkill and Navesink west branch, to the southwest and south. Graham Mountain is also the head of a long ridge in which reappears the normal trend of the Appalachian chains, which is also indicated by the course of the Navesink and of the Upper Rondout Creek. But all that region lies beyond the pale of my observations, and requires further investigation.

What was said of the geological structure of the Northern Catskills is true also of the Southern group.

Notwithstanding the greater variety of its plastic forms, which would, at first sight, indicate considerable dislocations, the nearly horizontal position of the strata, which predominates except in a few and limited localities, forbids the belief that these dislocations were the ruling element in their formation. The mountain chains are no anticlinals, nor are the valleys synclinals. Erosion and slow disintegration seem to have been the main efficient cause of the conformation of the surface.

I here add a classified list of most of the points measured. The altitudes are reduced to the ground above the mean tide-level in New York Harbor. B. means a measurement by mercurial barometer; An., by aneroid barometer; P. L., by pocket level.

Northern Catskills.

		Feet.
B.	Half-way House	286
B.	Palenville, Union Church	470
B.	Entr. of Kaaterskill Clove	609
B.	Palenville Hotel, lower bridge	680
B.	More Falls Bridge	883
B.	Lake Creek Bridge	1,217
B.	Haines's Falls, Chas. Haines	1,890
B.	Vista, Aaron Haines's Porch	1,932
B.	Bridge, Miles Haines	1,906
B.	Dixon's Hill	2,045
B.	Kiskatom	687
B.	Sleepy Hollow	1,290
B.	Catskill Mountain House	2,225
B.	Catskill Lakes	2,140
B.	Laurel House Piazza	2,038
B.	W. Saugerties, Quarrybank	660
B.	Head of Plaaterkill Falls	1,855

Schoharie Creek. — Main Valley.

		Feet.
B.	Head-waters Schoharie Cr'k	1,900
B.	Mulford's Summit House	2,043
B.	Tannersville Hotel	1,926
B.	Hunter Village, Rusk's	1,609
B.	Lexington Bridge	1,320
B.	Westkill Village	1,538
B.	Prattsville Hotel	1,164
B.	Gilboa Hotel	1,036
B.	North Blenheim Bridge	800
B.	Breakabeen Creek	743
B.	Fultonham Church	714
B.	Middleburg Railroad Depot	640

Schoharie Creek. — Tributaries.

		Feet.
B.	Peters Farm, East Kill	2,100
B.	Jewett Heights, Church	1,810

Valley of Batavia Kill.

		Feet.
B.	Big Hollow, Church	1,758
B.	Hensonville Cross-roads	1,646
B.	Union Society, Bloodgood's	1,670
B.	Windham Centre Hotel	1,510
B.	Asland Centre P. O.	1,435
B.	Redfalls P. O.	1,270

Valley of Catskill Creek.

		Feet.
B.	Cairo	346
B.	Acra	546
B.	Cornwallville	950
B.	South Durham	969
B.	West Durham	1,884
B.	Durham Centre	850
B.	Oakhill Bridge, Catskill Creek	609
B.	Cooksburg	756
B.	Preston Hollow	870
B.	Livingstonville	1,100
B.	Franklinton	1,260
B.	Potter's Hollow	870
B.	Smithton	1,268
B.	Highland House, Piazza	1,857
B.	Broome Centre, Hotel	1,973
B.	Makee's Corners	1,964

Central Chain.

		Feet.
B.	Woodstock, Hotel	594

B.	Mead's House	1,789
B.	Overlook Mountain House	2,978
B.	Overlook Mountain	3,150
B.	Plaaterkill Mountain	3,280
B.	Indian Pass	2,694
B.	Indian Head, East Peak	3,380
B.	" Middle "	3,510
B.	" West "	3,581
B.	Schoharie, East Peak	3,583
B.	" West "	3,650
B.	Mink Mountain	3,807
B.	Mink Hollow, summit road	2,629
B.	Stony Mt., east end	3,844
B.	" centre	3,823
B.	" west end	3,789
B.	Stony Clove, approximate	1,700
B.	Hunter Mountain	4,038
B.	Colonel's Chair, north end	3,087
B.	" " highest	3,165

Lexington Range.

B.	Rusk Mountain	3,626
An.	Evergreen Mt., approx.	3,624
An.	Bee Line " "	3,300
An.	Pine Island " "	3,086
An.	Lexington " "	2,930

Westkill Range.

B.	Big Westkill Mountain	3,896
P.L.	Deep Hollow Mountain	3,500
B.	Deep Hollow, summit road	1,978
R.	Beech Ridge Gap	3,096
B.	Vlaie, or Fly Mountain	3,531
	Halcott Gap, summit road	2,725
An.	Bearpen Mt., approx.	3,545
	Summit road to Batavia K.	3,180
B.	Ontiora, Little West Kill	3,458
B.	Utsyantha Mt., near Stamf.	3,208

Chain of High Peak.

B.	High Peak (Old Roundtop)	3,664
B.	Roundtop	3,500
B.	Clum Hill	2,372

North Border Chain.

B.	South Mt., near Mt. House	2,497
B.	Palenville Overlook	1,660
B.	Sunset Rock	2,115
B.	Point of Rocks	2,178
B.	North Mountain, Outlook	3,100
B.	North Mountain, East Peak	3,285
B.	" " W., Stopel	3,440
B.	Black Head	3,945
P.L.	Burnt Mountain	3,170
B.	Windham High Peak	3,534
B.	Grand View Hotel	1,670
B.	Cade Mountain	2,390
B.	Summit House	1,940
P.L.	Hayden Mountain	2,900
B.	Pisgah	2,905

East Jewett Range.

B.	Parker Hill, Star Rock	2,545
B.	Parker Notch	2,415
P.L.	East Kill Mountain	3,190
B.	East Jewett Mountain	3,146

Black Head Range.

B.	Black Head	3,945
B.	Lockwood Gap	3,446
B.	Black Dome	4,003
B.	Kimball Mountain	3,960
B.	West Peak, No. 4	3,566
An.	Delong Mountain	2,540
An.	Henson Gap, summit road	1,989
An.	West Jewett Mountain	3,025
B.	Tower Mountain	2,931

Pisgah Range.

B.	Pisgah	2,905
B.	Richmond Cone	3,202
B.	Sister Knob	3,002
B.	Ashland Pinnacle	3,420

Northwestern Catskills.

B.	Sutton Gap, road	2,235
B.	Sutton Hill	2,573
B.	Potter's Hollow Gap, road	1,964
B.	Koni or Pine Hill	2,837
B.	Bennet Notch	1,994
B.	High Knob	2,654
B.	Best Hill	2,649
B.	Barlow Hill	2,651
B.	Gordon Gap, road	2,504
B.	Gordon Hill	2,629
B.	Leonard Hill	2,649
B.	Manorkill	1,520
B.	Stone Bridge	1,382
B.	Strykersville	1,215
B.	Platt Creek Church	1,688
An.	Mine Hill	2,810

SOUTHERN CATSKILLS.

B.	High Point	3,098	B.	Balsam Mountain, north end	3,571
B.	Peak-o'-Moose	3,875	B.	Belle Ayre Mountain, max.	3,394
B.	Table Mountain	3,865	B.	Graham Mt., — Dry Brook	3,886
B.	Dominie Hammond's House	1,945	B.	Doubletop	3,875
B.	Lone Mountain	3,670	B.	Segar's House, — Dry Brook	1,923
B.	Cornell Mountain	3,681	B.	Molyneux House Porch	1,315
B.	Wittemberg Mountain	3,778	B.	Guigou's Boarding House	1,439
B.	Woodland, N.W. Beach's H.	1,140	B.	Pine Hill Village	1,512
B.	Pantherkill Mountain	3,828	B.	Undercliff	2,200
B.	Slide Mountain	4,205	B.	Rose Notch	2,743
B.	Helsinger Notch	2,677	B.	Birch Kill Notch	2,334
B.	Sprucetop	3,567	B.	Monkey Hill (Mucky)	2,489
B.	Eagle Mountain	3,560	B.	Halcott Mountain	3,504
B.	Balsam Mountain, south end	3,601			

Elevations above high water of Rondout, by levels of the Ulster and Delaware Railroad; communicated by Geo. Coykendall, Superintendent.

Rondout	2	Shandaken	1,069
Kingston	155	Big Indian	1,209
West Hurley	540	Summit	1,886
Olive-Branch	511	Griffin's Corners	1,516
Brooks's Crossing	525	Dean's Corners	1,344
Brodhead's Bridge	500	Halcottville	1,399
Shokan	583	Stratton's Falls	1,456
Boiceville	598	Roxbury	1,497
Mount Pleasant	690	Grand Gorge	1,570
Phœnicia	790	Stamford	1,767
Fox Hollow	996		

Mount Carrigain.

BY CHARLES E. FAY.

Read July 9, 1879.

MOUNT CARRIGAIN may justly be considered the geographical centre of what is commonly known as the White Mountain region. Taking the most accurate map of the district as yet published, the new State atlas, drive in a pin through the summit of Carrigain; loop over it one end of a strong thread; stretch it due south, and it will be found to pass over the summit of Red Hill and just miss on the right the village of Centre Harbor. Take the distance to Centre Harbor, say

twenty-seven miles, as a radius. Laying it off due east, it will be found to pass over the Bartlett spur of the northern Kearsarge, and reach the Saco in Fryeburg a fifth time as it returns upon its course in the great bend. Due north it will pass beside the Fabyan House, and wholly include Mount Starr King; and due west, crossing the summit of Mount Pemigewasset, it just falls short of the Connecticut River as it flows by Haverhill. The circle thus described will have upon its periphery Ossipee Lake, Lovell's Pond, Mount Hayes near Gorham, and the villages of South Lancaster and Plymouth, and include all peaks of primary, and a majority of those of secondary importance in the State. Mount Lafayette, and Mount Pleasant of the Presidential range, are equally distant (about eleven miles) from Carrigain as a centre. The base of the isosceles triangle thus formed passes over the South Twin near its highest point. This base plus one of the equal sides equals the radius of the circle just described. Again, Carrigain is just half-way on the meridian between the Fabyan House and the crest of the Sandwich range, the southern parapet of the wilderness region. It will thus be seen that no mountain can more truly claim to be the centre of this interesting region.

Starting from the Crawford House, and proceeding southwest over Mount Willard, one would first find the shelter of a human habitation after a journey through the forest, over mountain and stream, of full twenty miles in an air line. This extensive wilderness, which would have been crossed by a short diagonal, is what has been called the "Pemigewasset Forest." It is drained chiefly by the East Branch of the Pemigewasset River, which has many tributaries flowing in from north and south from subordinate valleys and ravines. A portion of the water which falls in this district finds its way in a southwest course, by way of Mad River, into the main stream of the Pemigewasset at Campton; other portions, by way of Sawyer's, and, farther south, Swift River, into the Saco. Sawyer's River is the first tributary of any considerable importance that enters the Saco from the west, at its first great bend to the eastward, about eleven miles from its source. Carrigain, on the southeastern limits of the basin of the East

Branch, is so situated that its northerly slopes are drained into that stream; its southerly, into Sawyer's River. It is by the valley of this latter that it is most readily approached, its summit being scarcely more than seven miles by the path, and nearly due west from the Livermore station near the confluence of the two streams.

Although Mount Carrigain attains an altitude of over 4,600 feet, and may therefore be classed with the Twin Mountains and Moosilauke, it is so situated with respect to the ordinary routes of travel that tourists might swarm in the usual places of resort, and never know of its existence. Hidden from view by nearer mountains of less altitude, from none of the frequented thoroughfares is it in any degree visible save one, and that only for a few miles in a portion where few persons tarry though thousands pass,—the Upper Bartlett section of the Saco valley. It did not, however, thirty-five years ago escape the admiring and appreciative eye of one of the gentlest lovers of Nature as well as one of the most learned men that ever visited these scenes. I refer to Dr. Hosea Ballou, 2d, first president of Tufts College, the elder friend and ever congenial companion of Thomas Starr King. Describing a tour of the mountains made in 1844, he thus writes: "As we pass out of the village [he is speaking of Lower Bartlett] we turn short in the same direction [west] which is the course we are to hold for the next ten or eleven miles. If we look back, after entering this western reach, we see Pequaket [the northern Kearsarge] towering in the rear at the eastern end of the valley; but we lose sight of Washington, and of the distant mountains that stand beneath his shadow. . . . Ahead, we see, over and far beyond the tall hills that seem to close up the western end of this passage, a long blue summit sweeping off either way in a jagged outline that comes down from its loftiest point in the sky. Its southern contour has nearly the same form as that of the Washington Range when seen from Conway or Bartlett; and if we forget the points of the compass, we may naturally mistake it for that mountain, though it really stands in the direction of Franconia. Is it Lafayette?"

No, it is Carrigain; yet had he asked its name at that day, he would probably have learned that it was one of the many

nameless peaks.[1] In this short portion only of one of the routes among the mountains is it a prominent, if indeed visible, object in the landscape, and still to decrease the chances of its being seen by tourists of the new generation, the cars are running for most of this distance directly towards it. From more distant points to the eastward, as from the city of Portland, and, of course, from the summits of the mountains most commonly ascended, it presents an imposing form among the multitude of giants. Dr. Ballou's comparison of its profile to that of Washington is very apt. In one essential particular, however, it presents a different appearance from a near point of view. It is clothed with forest to its very summit, only somewhat bared and scarred upon its eastern, precipitous slope, where it descends a sheer two thousand feet into the Carrigain Notch, the narrow defile between itself and Mount Lowell. Of this pass Professor Vose has said: "The slopes of these two mountains in Carrigain Notch are more imposing, on account of their exceeding steepness and of their great height, than any others yet described in the White Mountains."

In the case of a mountain so grand and so remote from usual lines of travel, it is of interest to know to what extent it has been ascended, and who was first tempted to assault its lofty stronghold. Is it not a revelation of the recentness of the awakening of the alpine spirit among us, when we learn that the first known ascent of a peak to-day considered so inviting was made in September, 1869? Visible, as I have said, from Portland, Maine, and, no longer foreshortened, giving from that distance a correct impression of its gloomy grandeur, it first succeeded in awakening the spirit of adventure in gentlemen of that vicinity. Thanks to Mr. J. M. Gould, Secretary of the Portland White Mountain Club,—the first organization of the sort ever attempted, so far as I am aware,

[1] It is generally understood that the mountain derives its rich, full-sounding name from Philip Carrigain, Esq. (died in Concord, N. H., in 1842, æt. 70), sometime Secretary of State of New Hampshire, and under whose care the State map of 1816 was prepared. This was a notable work for its day, for which, as well as on account of his manifest love for, and pride in, the mountains of his native State, he well merits this memorial. I have been unable to discover by whom the name was bestowed, but find it first in Colton's Atlas, edition of 1857.

in America, — I am able to present authentic records of the first ascents known to have been made.

He writes: — "The first Carrigain party from our Club was on Sept. 20, 1869, Prof. Vose and Mr. G. F. Morse with J. O. Cobb for a guide. . . . At that time and previously it was supposed that Carrigain had never been visited by a white man, unless posssibly Prof. Guyot had gone there. It was impossible to find any hunter or 'gummer' who had gone farther than the base of the mountain; and Mr. Morse and also Prof. Vose were unable to learn that the peak had ever been ascended. We have never learned yet whether Prof. Guyot was there, nor have we any information that white men were there ahead of the 1869 party. The course was up Sawyer's River to Duck Pond Brook, thence by 'Greeley trail' over a little hill lying between this brook and Carrigain Brook; then, leaving the trail, they went some distance along flat land and at length struck Carrigain Brook and followed it up to what they took to be the summit. After waiting hours for it to clear up, they descended and found when well down that they had not been on the top, but on the long ridge running out to the southeast, which we have since named 'Burnt Hat Ridge.' In commemoration of this trip Mr. Morse named the spur on the northeast 'Vose's Spur.'"

"August 29–31, 1873, the *famous* Carrigain party made its ascent, — six, and two hired men. An attempt to shorten the distance and avoid the hill between the two brooks led to almost serious mishaps. The guides knew nothing of the country they were in, and the party wandered all one day over the worst kind of obstructions and without water. Late after noon they came upon Carrigain Brook again (having crossed it early in the day) and thereupon they camped. There and then the 'White Mountain Club' was organized. Next day they went up the mountain. Arrived at the ridge, a furious storm overtook them and drove them into the scrub below. Mr. Davies's hat was blown into the fire and burnt, — whence 'Burnt Hat Ridge.' The party went to the summit after the storm was past and got home safely, though a number of the members were made sick by the overwork."

"August 29–31, 1874. . . . This party was the first to carry

a barometer. Prof. Vose's calculation from observations made this trip gives 4,625 feet, against Guyot's 4,678. Guyot's was made on the basis of the height of Saco Valley, now known to be incorrect. A bottle with records was deposited on the summit."

"June 9–11, 1875. . . . made ascent same route. Mr. Morse finished his profile-drawing. Uneventful, except that it was the easiest made of any trip. . . . On this trip I made accurate note of the time taken in going up and down, with time of halting. . . . We were 'dropped' by the conductor of the P. & O. R. R. at Sawyer's River. Here we put on our packs and marched into the woods by a road and path, for a mile or two. [This is the first record of any road.]

	Time.	Time.
Railroad (P. & O.) to Duck Pond Brook,	Halts, 30 min.	March, 75 min.
Up Duck Pond Brook to a slide and blazed tree,	" 47 "	" 90 "
Across flat land to Carrigain Brook,	" 11 "	" 32 "
Up Carrigain Brook to Camp Organization,	" 13 "	" 58 "
NEXT DAY.		
Camp to Burnt Hat Ridge,	" 25 "	" 110 "
	126 "	365 "

Or say 8½ hours gross from R. R. to Burnt Hat Ridge. (*I* did not go to summit). Time down was 4¼ hours gross (halts 15 minutes)."

"In August of 1875 a party of four men, including Mr. Fox of our Club, went up the valley, keeping in the brook beds all the way, going ashore occasionally to 'thaw out.' I judge that they ascended nearly to the foot of Vose's Spur, and there camped, then waded through a morass, reached 'Burnt Hat Ridge,' went over the summit, and down the other side, and followed the Pemigewasset River into the land of civilization. . . . This party went up the *North* Branch of Carrigain Brook, thinking it would take them to the foot of Vose's Spur. The brook dwindled to nothing, however, and ended in a sort of swamp, as before stated. All the other parties followed up the more southerly branch, which comes out from under the precipitous sides of the mountain and ridge."[1]

[1] In addition to the above names Mr. Gould mentions Prof. E. S. Morse, Major Sanger, Mr. C. L. Clarke of Bowdoin College, and Mr. N. W. Swasey. The

As we read these reports of necessary camps, of bewildered guides, of sickness resulting from over-exertion, we are tempted to look again at the dates. Can it really be that four years have wrought such changes in the way of rendering Mount Carrigain accessible? It is safe to say that the actual labor of the ascent from the Saco River has been diminished by two thirds since the trips described above. Then it was a journey into the primeval wilderness from the time of leaving the stage-road. To-day the entire distance thence to the very base of the mountain, between five and six miles, including nearly all the portion where the way is likely to be lost or seriously obstructed, may be traversed by clearly marked roads, and when these cease, a good foot-path continues on to the highest summit.

For the opening of this most attractive peak to a large number of lovers of wild, grand scenery, who never could have overcome the original difficulties of the ascent, thanks are due first of all to commercial enterprise, and next to the liberality and the *esprit de corps* of a representative body of American teachers. In what four years ago was one of the most inviolate sanctuaries of Nature, the axe of the lumberman has cut the first clearing. He has erected his rude village of unpainted cottages and his restless steam-mill, and up the rapidly ascending gorge where the Sawyer's River rushes as a foaming torrent, he even spurs the iron monster of the lowlands. I am informed by Mr. C. G. Saunders that the first mill of the Grafton Lumber Company was built here in 1876, and the railroad completed in the following autumn. In the mean time a second mill has been built, ten to twelve million feet of lumber cut, and the greater part of the Pemigewasset Forest incorporated as the township of Livermore, the only

only other ascents made previous to 1879 of which a record exists are the following: — 1. By a party connected with the State Survey, in August, 1871, up the easy northwest slope from the valley of the East Branch, described by Mr. Warren Upham in APPALACHIA, Vol. I. pp. 34, 35. — 2. By Mr. M. F. Sweetser, with the guide-book party, from the southwest side, probably in 1876. — 3. By Ex-Presidents Pickering and Scudder, of this Club, by Sawyer's River and the southeast spur, July 11, 1878. — 4. An excursion of the Club, composed of twelve members and eight guests, on August 28 of the same year. Mr. G. T. Crawford and others connected with the Grafton Lumber Company have also made occasional ascents.

settlement of which is the rude hamlet at the mills. The mills themselves are situated on Sawyer's River, about two miles and a half from the Saco, and more than four hundred feet higher than the confluence of the two streams, and here is the present terminus of the railroad. A common road also leads hither, a wild, rough way through the forest, apparently little travelled by carriages,—even more primitive in its kind than the railroad. About the mills the forest has been entirely cleared for the area of perhaps half a square mile, and part of this is already under cultivation. From this clearing logging-roads run in various directions, following especially the streams. These roads often fork, and one is of course liable to choose the wrong path in seeking the foot of the mountain, a danger which will soon be obviated by the erection of guide-boards. The proper road crosses Whiteface Brook, follows it for some distance, then, turning abruptly to the left, traverses the flat land mentioned by Mr. Gould. Just before coming to Carrigain Brook, a dilapidated logging-camp is passed, and not long after, at about three miles from the mills, the road ends in the litter and tangle of a wood-cutters' clearing. At this point begins the path now nearly completed under the direction of our Department of Improvements, with funds subscribed by members of the American Institute of Instruction,—one of the two memorial paths constructed under its auspices to keep alive in the region the traditions of the first grand meeting of teachers in the White Mountains, in July, 1878. This leads up the steep slope of the spur known to the Portland club as "Burnt Hat Ridge" to its crest, then on through the low growth of spruces, a quarter of a mile farther, and perhaps four hundred feet higher, to the culminating point. This summit, as will be seen by reference to Mr. Upham's article in APPALACHIA, I., p. 35, was formerly covered with a peculiar gnarled growth, but has recently been cleared by our path-constructor and affords an unobstructed view in all directions. And what a view! The description of the position of the mountain with reference to the great wilderness and the various ranges may serve as a suggestion of what it is useless to seek to describe; of the still, solemn wildness of the forest-wrapped valleys and ravines in the fore and mid-

dle ground; of the panorama of lofty, massive ranges that rise on every hand and seemingly not far away, and, where these lines chance to sink away, parallel after parallel of ever hazier, more phantom-like ranges and peaks, out to the distant horizon. Few if any of the high peaks of New Hampshire have less of the human element within the compass of their view. As a position for a comprehensive topographical study of the several groups that go to make up the White Mountains, it is perhaps unrivalled.[1]

As a contrast to the difficulties attending those earlier ascents of Carrigain, it may be of interest to compare a few notes of the excursion made by our Club on August 23, 1878. The party consisted of twenty persons, three of whom were ladies who had spent the previous day in an ascent of Moat Mountain by the Appalachian path. North Conway was our point of departure, and our company took passage by rail with a large body of tourists, who, under the auspices of the Club, were to make that ever-new excursion through the Notch. We separated from the main company at Livermore station, the junction of the wood-road with the Portland and Ogdensburg Railroad. By the courtesy of Messrs. Saunders a locomotive and platform car were put at the service of the party, and soon we were advancing in front of our engine up the steep grades and around the sharp curves of this remarkable bit of railroad. In perhaps twenty minutes we were at the mill. Spending a few moments in preparations for the march, we were under way at 8:30 A.M. Without any haste, indeed making frequent short rests, Carrigain Brook was reached at 9:35. Here a pause of ten minutes was made, and the end of the logging-road reached at ten o'clock, an hour and a half from the mill. About three hours and a half was spent in climbing from this point to the crest of "Burnt Hat Ridge." This part of the journey was performed under the original conditions, for as yet the Institute Path existed only as an anticipation. Probably a third, possibly one half, of the time was spent in

[1] An excellent idea of this noble prospect may be obtained from the panoramic view in the Atlas accompanying the Geology of New Hampshire by Prof. Hitchcock. It is from the sketches of Mr. G. F. Morse, mentioned by Mr. Gould on page 118.

frequent rests, and much was consumed in cutting a way with axes through the scrub near the summit of the ridge, which was attained at 1:40 P. M. The majority of the party, including one of the ladies, continued on after lunch to the true summit, reaching it in twenty-five minutes. The return to the mill was made by the "rear-guard" of the party in two hours and a half. How far from the minds of the hardy explorers of 1869, plodding down this then undisturbed ravine, the hearty repast served us on our descent by our fellow-member, Mr. G. T. Crawford, of Livermore, in the hotel of this hospitable infant village; or the vision of twenty unwearied visitors to Carrigain swarming upon the locomotive, which then bore us down to meet the return of our excursion train from Fabyan's! Thus in about twelve hours from North Conway and return was made the once formidable two days' trip.[1]

A Three Days' Tramp on the Mt. Washington Range.

BY W. H. PICKERING.

Read August 20, 1879.

THE object of this expedition was twofold: as an exploration of the Gulf of Slides, and as a study of the snow formation in Tuckerman's Ravine. So far as I am aware, the position of the Gulf of Slides is not indicated on any map hitherto published; it is rarely, if ever, visited by summer residents, and its attractions therefore remain unknown to the travelling public. It is a broad and deep ravine, situated directly south of and next to Tuckerman's, and is usually pointed out as such from North Conway, whence it is very conspicuous. The traveller from Conway to the Glen, one quarter of a mile after passing the guide-board indicating Glen Ellis

[1] On August 28, 1879, the writer, accompanied by Mr. Werrin, of Waltham, made the ascent of Carrigain for the purpose of inspecting the new path. The whole distance from Livermore Station, P. & O. R. R., to the highest summit was walked in 4 h. 42 min., of which 1 h. 20 min. was spent in halts. The return was accomplished in 2 h. 20 min., of which 30 min. is to be deducted for halts.

Falls, may notice on the left a high rocky cliff which is situated among the trees some fifty yards back from the road. This is the New River Cliff. In 1775, a great storm occurred in the mountains, and a river hitherto unknown appeared, which, flowing out of the Gulf of Slides, dashed over this cliff in a cascade some 300 feet in height. This probably is the cascade to which Belknap referred as the "noble falls" near the mouth of New River. Unfortunately another storm occurred in 1826, which changed the bed of the New River to its present position, a few rods to the north; and now only a small stream trickles over the cliff. Not merely geographically, however, but also historically, is the Gulf of Slides of interest. By it, Cutler, Boott, Bigelow, and the other early visitors to Mt. Washington, from this side of the mountains, made the ascent. The trail has, however, long since fallen into disuse, and not a trace of it is now left to show that man has ever been there before.

Regarding the second object of our trip, there exists, as is well known, in Tuckerman's Ravine, during the summer months of June and July, a large accumulation of snow. This usually lasts through the middle of August, and has occasionally, I am told, been known to remain till the following winter. It had often occurred to me that here might still be found the same glacial action which had existed so many thousand years ago, when the whole ravine was filled with that mighty mass of ice of which this is the insignificant remainder. To test this question, I had started with a party for Mt. Washington, via this route, on the 7th of July last. We were the first party of the season, and we found very large patches of snow in several places. The shape of the great patch will be best represented by a Y, imagining the space filled up between the branches. It must have been about 1,000 feet long by 300 feet wide, and 100 feet deep in the deepest portion. On the surface were scattered numerous irregular stones, six to twelve inches in length. On examination, each stone was found to be occupied by from two to six Colorado beetles, mostly in a benumbed or dying condition. I collected a number of these stones and placed them in a line across the snow, just below where the branches of the Y meet. A cairn of stones was then built at each end, on the neighboring rocks. The stones and

cairns were placed in a straight line, so that if any one should come a few weeks later and find that the stones were lying a little further down the ravine, he would know that it was due to the fact that the snow was slowly sliding down the mountain.

But to return to our expedition. Like true Appalachians, we had waited for a drenching two days' storm, and had watched it clear off with a glorious sunset. The next day, July 25, heavy clouds still hung upon the Mt. Washington Range, but elsewhere everything was bright and beautiful, and we started off in good spirits, knowing that, if the weather followed its usual course, the clouds would disperse during the afternoon, and give us a fine sunset and good weather the next day upon the mountains. We left Intervale at 8:30 A. M., arriving at the Cliff by twelve. It would have been better if we could have started two hours sooner, for the early morning is the time to enjoy a ride in the mountains, and we should have reached the summit so much the sooner. We were unfortunate enough to lose on the way the paper containing our times and distances; therefore those which follow must be considered, generally, as only approximate. Arrived at the foot of the Cliff, we bade good-bye to our driver, adjusted our haversacks, and were soon climbing up the steep face. Probably future explorers would find it easier to follow the present bed of the New River, or to strike the old bed higher up, but we wished particularly to explore the cliff, and therefore clambered up its face. The stream above was nearly dry till it joined the present New River, and furnished easy walking for about a mile and a half; when we entered a narrow gorge with steep rocky walls, over 100 feet in height. Rounding a curve we suddenly saw the end of the gorge before us, closed by a high rocky wall, down which the stream came bounding in three leaps, forming a beautiful cascade over seventy feet in height. At the lower fall, which must have been thirty or forty feet high, it cleared the overhanging precipice, and came down a mass of foam into a deep rocky basin below, whence it flowed out as quietly as a meadow brook. Between the second and third falls is a level platform of rock, from which a fine view is obtained down the gorge, and here we stopped to rest and eat our dinner. Half

a mile further up, we came to a second cascade, resembling, in general, the Silver Cascade of the Crawford Notch; and half a mile further, still another, which was perhaps the most curious of all. It was composed of several falls, which did not form a straight line, as usual, but a zigzag, giving it a very odd appearance. The view at this point was very impressive; we were now well within the Gulf, the towering walls of which, scored with the numerous slides from which it takes its name, shut us in completely on the front. The view on either hand was limited by the dark primeval forest, while the pretty fall in the foreground added life to the otherwise somewhat sombre picture. But now the steepest part of our climb was before us, and selecting the northwest corner slide as that best answering our purpose, and most nearly agreeing with the Guide Book description, we were soon making our way over the loose stones and gravel which form its surface. From the top of the slide a short walk brought us to the crest of Boott's Spur at 5:15 P. M., and at seven we stood on the summit of Mt. Washington. We had a fine sunset, and the horizon was very clear.

The writer suggests that the cascades discovered on this trip be known collectively as the Appalachian Cascades, in honor of the Club. In point of height and quantity of water they are surpassed by both the Glen Ellis and Crystal, but in surrounding scenery they are inferior to none in the mountains, so far as I am aware.

The next morning was very clear in the northeastern horizon, and advantage was taken of the opportunity to sketch careful profiles in the direction of Katahdin. These and certain camera profiles drawn on a previous occasion by Mr. Edmands, taken in connection with the known position and elevation of Katahdin, show conclusively that its summit is hidden 2,000 feet below one of the highest cols of Mount Abraham. The only one of the White Mountains now left from which there is any chance of seeing it is Carter Dome, and it is very doubtful if it can be seen from there. Having completed our profiles, we crossed over to Mount Adams, thence down by King's Ravine and Lowe's Path to the road, where we separated, my friend going to the west and I to the Ravine House, where I passed the night.

The next morning, I drove through Pinkham Notch to the path leading in to the Crystal Cascade. The walk thence through the ravine was uneventful, and in about three hours I reached the snow patch. Much of the snow had melted, so that some of the stones placed upon it were gone, but of those that remained the middle ones had moved about thirteen feet in twenty days, or at the rate of eight inches per day. The side ones had not apparently moved quite so fast. The surface of the snow was convex, being considerably higher at the middle. Where not exposed to the sun, the snow was very hard, and differed from ice only in color. The roof of the ice cavern was now quite high, and it could be entered for some fifty feet or more, although wading through ice-water in the dark may be considered more unusual than agreeable. From the above, it would appear that we have here the same glacial action that occurs on a much larger scale in the Alps, the same transportation, and therefore grinding, and polishing of the rocks, the same phenomena of viscosity and regelation; only that we here miss the long tongues of blue ice, with their accompanying crevasses. Our snow-patch, therefore, corresponds to the *névé*, or upper portion of a glacier, the whole of the lower portion being wanting. It might, perhaps, be called an incipient glacier. We arrived home without further adventure, well repaid for our three days' tramp upon the Great Range.

Baldcap Mountain.

By Mrs. L. D. and Miss Marian M. Pychowska.

Read August 20, 1879.

On the north side of the Androscoggin, nearly opposite the Shelburne station on the Grand Trunk Railroad, rises Baldcap, a mountain lying partly in the town of Shelburne and partly in Success. It is in fact a miniature mountain system, consisting of several chains of ledge-crowned knobs radiating from a great central mass. The hollows between its many heads are the resting-places of pretty ponds, and the streams of which these are the sources only find the valley by steep

plunges over the great walls of granitic rock. Mr. E. B. Cook (A. M. C.) and the ladies of his family, often accompanied by other friends, made this mountain an object of exploration during several seasons, namely, 1872, 1873, 1875, 1876, and 1877. In the following sketch, the pronoun *we* will be frequently used, but any considerable result from the explorations must always be referred to the superior knowledge of woodcraft, and the almost unerring divination of the best route to reach an end, possessed by Mr. Cook.

The central mass of the mountain rises from the river, in four rocky terraces or knobs, each one to the northward higher than the preceding. The heights of these points were *approximately* ascertained by Mr. Cook with a Casella aneroid, using the Smithsonian tables of Prof. Arnold Guyot. The knob nearest the river is known as "Mt. Joe," and is about 1,670 feet in height (above the sea level); the next elevation, having no proper name, was called by us temporarily "Middle Mountain," and attains an altitude of about 2,000 feet; next follows the bare, ledgy front from which the mountain takes its name, and which is the part usually visited; this measures 2,736 feet. The view from this point scarcely equals that from Mt. Hayes, and, like that view, is cut off toward the north or northeast by the long back of the mountain. Descending from this crest toward the north, a little west, for a mile or more, a shallow pond is reached, known to many as Dream Lake, the elevation of which is about 2,600 feet.

Our usual mode of ascent from the valley was over Joe and Middle Mountains, to the ledgy front top; and, in the summer of 1877, Mr. R. S. Chase (A. M. C.), of Haverhill, Mass., and his sons cut a path over this route as far as Dream Lake. In climbing the main front of the mountain, it is better to keep well to the right, as the ledges are very steep.

From the northeastern end of Dream Lake, a unique view is obtained of Mts. Washington, Adams, and Madison.[1] The upper half of these blue peaks is framed in by the pretty sheet of water and its wild, spruce-grown shores, the whole intervening country being hidden. About midway of the mossy

[1] The Club owns a picture of this view, painted and presented by Miss Edith W. Cook, of Hoboken, N. J.

southeastern shore is an excellent spring, most acceptable at dinner-time.

At the end of three seasons spent near its foot, our knowledge of this part of Baldcap was bounded by this lake. Our resolution to find the true summit was formed by observing the mountain, first from Mt. Moriah, and afterwards from the Gorham road, the attractive point being a dark, dome-like mass, evidently overtopping all about it. This summit was finally reached (July 27, 1876) by Mr. Cook, another gentleman, and three ladies. This highest peak of Baldcap measures about 3,080 feet above the sea-level. The route to be followed from the lake is west of north, over a gentle rise, across a small stream, and then up the dome. The birch and spruce woods are readily passed through, and the distance from this point to the front ledge, usually visited, is about two miles. The entire distance from the "Gates Cottage" to the highest summit of Baldcap, by the route here described, is between four and five miles, as roughly guessed, no measurement having been made.

As to the top itself, fire once swept away the great trees, whose bleached stumps remain, and the young spruces, growing between the ledges, do not materially obstruct the view, which is clear in every direction. In addition to the White Mountains proper, the Carter and Moriah ranges, Royce, Caribou, Baldface, and other heights on the Maine border, are well seen; then come the hills about Bethel, and the long ridge of which Robinson's Peak is part; and then an old friend, known to us as "Success" (being in that town), but named on Mr. Walling's map Mt. Ingalls. Just beyond are "Carlo" (so called by us after a faithful walking companion of Mr. Cook's), the remarkable peaks of Goose-Eye, and the elephant-like Speckled Mountain (Old Speck) of the Bear River Notch.

Thus far, the broad flanks of Baldcap have shut us off from all intervening valleys, but now, toward the north, the dome on which we stand slopes rapidly away into the wide Success wilderness, beyond whose velvety folds and waves rise the blue mountains about Lake Umbagog and the Dixville Notch. Again, to the left, we look down on Berlin, just below us, and away up the Androscoggin, to the wild country beyond

Dummer. Among the lesser hills to the west, the inevitable Percy peaks are conspicuous, seen up the Dead River valley. Then the Pilots, Randolph Mountains, and Cherry Mountain, would bring you to the great peaks once more; but, if you will look critically at the sharp edge of Jefferson or Adams, you will observe a distant serrated line and slope. This line can be no other than that of Mt. Lafayette. This fact was verified in 1878, from the top of the latter peak.

One way of descending Baldcap is by following down the outlet of Dream Lake. This stream is known as the Peabody Brook, and on it are the Giant Falls. These falls lie on the western flank of the central portion of the mountain. After a heavy rain, these truly magnificent cascades are visible from the high road near Lead-mine Bridge, and it is at such a season that they should be visited. From their head, a charming view is obtained of the long ravine in which they lie, with the crest known to us as "Wallface" on the right, and the great peaks far away over the Androscoggin valley. The stream shoots and slides for several hundred feet over successive ledges of solid rock, and, when the water is high, the effect is imposing. The Giant Falls are well known in the neighborhood, the distance to them being only from one and a half to two miles from the Peabody farm, and the way very easy. In 1878, a path was cut to them, following the western bank of the brook.

The only one of Baldcap's ponds on the Walling map is Page's pond, which we saw for the first time from the mountain summit, lying far below us. We visited it soon after, by way of the Lead-mine Brook, making acquaintance with three more of our mountain's westernmost knobs on the route.

Let us now pass to the treasures on the eastern slopes. At different times the late Mr. Harvey Philbrook and Mr. Lary (of Shelburne) spoke to us of a remarkable "flume," which they had seen years before on a logging expedition, and whose situation was somewhere between Baldcap and "Success" (Mt. Ingalls); where, exactly, Mr. Lary could not tell us. This information was the key-note of our explorations in that quarter, for every new water-fall we came across was conjectured to be the flume. During the summer of 1873, we fre-

quently observed from the high-road, or the hill west of Mr. Philbrook's boarding-house, a bare rock on the southeast wall of the mountain, over which sparkled a stream, said stream becoming a torrent of foam in wet weather. Two of our ladies (one now a member of the Club) made a preliminary investigation of a route to this fall, by following one of the Mill Brook wood-roads as far as the logging camp, about two and a half to three miles from the high-road. This camp is built upon the branch of Mill Brook on which the fall was afterward found. Sept. 28, 1875, Mr. Cook and party ascended the branch and climbed the cascade, a very beautiful one in wet weather. The name, Dry-ad Falls, given by Mr. Cook, alludes to its aspect in any but a rainy season. Under the proper conditions, it is nearly as fine as the Giant Falls. The water descends over steep ledges several hundred feet, and the climb to the top is rewarded by fine views down the Mill Brook ravine and towards Mt. Success. The stream above leads back into the high, wild hollow of the central mountain mass, and the adjoining eminences command some peculiar views of the surrounding heights.

Not yet satisfied that we had found the "flume" spoken of, and always attracted by the chain of heads leading off toward Mt. Success, on Sept. 12, 1876, we followed our usual route to Dryad Falls, and then, scaling the more northerly heights and keeping along the edge of the steep eastern slope, we gained a summit whose cliffs barred farther progress to the north. Turning westward, down an incline, we soon came upon a small sheet of water, partially filled with lily-pads, and surrounded by beds of moss. This was an explanation of the deer tracks which had so often helped us through a stiff place in the spruces, and here (as at the other ponds) we found quite recent prints of hoofs on the soft shore. The outlet led us to the north, by lovely cascades, to a lower terrace, where another surprise awaited us. This was an exquisite pond, larger than the other, occupying a hollow, cliff-surrounded on three sides, and from whose eastern end there is a picturesque view toward Success, and over the Androscoggin valley to the Royce and Caribou group of mountains. Having gathered some bottle-gentian by the shore, we ventured to bestow the name of Gentian Pond.

The upper sheet of water we had named "Caribou Pond," but finding later that "Mt. Calabo" in Maine was rightly "Mt. Caribou," we thought that name liable to occasion confusion, and now suggest "Moss Pond" as a more appropriate appellation.

The waters from Gentian Pond find the Mill Brook valley by a succession of falls, beginning at the very mouth of the lake. The rocks are overgrown with dark, green moss, from whose trailing ends the water descends in threads, in dry weather, suggesting to "our artist" (Miss Cook) the idea of calling them the "Dripping-Wells." Not far from the foot of these falls, we struck the head of an old wood-road, which, though a rather rough guide, conducted us past an upper logging-camp to the well-known one on the Dryad Falls branch.

Again we had seen many treasures, but not the "flume," although, as we afterwards discovered, we had passed within 200 yards of it. Four days later (Sept. 16), Mr. Cook, with two ladies, made a final search, rewarded with success. At the point where the wood-road to the lower logging-camp crosses to the west bank of Mill Brook, and diverges from it, we took to the stream, determined to see its whole course. Above the junction of the Dryad Falls branch the brook has no important fork until just below the wood-road head which we had struck on our previous excursion. Here we found the long sought object, exactly as described by Mr. Lary. The branch coming in from the right (looking up stream) passes between perpendicular walls of rock, to join that from Gentian Pond, and offers a sort of miniature likeness of the great Franconia Flume.

Curious as the place is, and glad as we were to have found it, we would not give in exchange for it our other Baldcap knowledge. "Lary's Flume" is about four and a half to five miles from the high-road, and may be reached by an old logging road, but the latter has too many forks to make it possible to give a satisfactory description of this route. Below the Flume, on Mill Brook, are several beautiful cascades, only to be seen by following the stream, and on the same brook, about a mile from the high-road, are the well-known "Bowls and Pitchers," curious falls and pot-holes worn in the solid granite.

The same day we climbed the height beyond Gentian Pond, in the hope of obtaining a view into the Success wilderness, but could find no bare ledges looking northward. This knob is, I believe, Baldcap's last outlier in the direction of Mt. Ingalls (Success).

Aug. 17, 1877, Mr. Cook and party, with Mr. Chase and his sons, made the whole round of Dryad Falls, Moss Pond, Gentian Pond, Dripping-Wells, and Lary's Flume, in one day.

Barometric Observations.

BY F. W. CLARKE.

THE accompanying table of altitudes in the White Mountain region has been computed from barometric readings, made by Prof. C. R. Cross and myself, chiefly during the summers of 1876 and 1877. A very few of the figures depend in part upon work of my own done in 1874 and 1875, and a few more represent observations made exclusively by Prof. Cross. In order that the value of the measurements may be correctly estimated, I will preface the table with a rough outline of the ground covered, and try to indicate the manner in which our results were obtained. Some points of nomenclature also require explanation.

1874. This season I spent about a week at West Campton, equipped with a compensated aneroid, by Green of New York. Observations were made upon the height of Cook's Hill, of Waterville, of Campton Village and West Campton, and these were verified by new measurements taken in 1875 and 1877. During this year observations were made by Prof. Cross to determine various altitudes in the lake region, south of the mountains, a siphon mercurial barometer being used.

1875. About three weeks were spent at West Campton, with a compensated aneroid by Casella. Nearly all the work of 1874 was repeated, and fresh observations were made upon Mts. Osceola and Tecumseh. In 1877 all these measurements were verified, with the exception of those taken upon the highest peak of Tecumseh.

1876. Nearly five weeks were spent at the Starr King House, Jefferson. My own instrument was the Casella aneroid of 1875; and Prof. Cross, who was with me for about three weeks, was provided with a siphon mercurial barometer. Most of the work, however, had to be done with the aneroid, as the mercurial barometer unfortunately got out of order at an early stage in our operations. The height of Jefferson Hill was fixed by many barometric observations connecting it with the railroad stations at Lancaster, Whitefield, Bethlehem, the Twin-Mountain House, and Fabyan's. We also ascended Mts. Adams and Madison, and the Owl's Head on Cherry Mountain, and made numerous measurements at minor points of interest. On August 5th, in order to directly compare the heights of Bethlehem and Jefferson, we drove from the Starr King House to the Sinclair House by way of Dodge's at Whitefield and the Whitefield Depot, and back via the Twin-Mountain House, Fabyan's, and the Cherry Mountain road. Upon this excursion, a series of seventeen aneroid readings was taken. Prior to my own arrival at Jefferson, Prof. Cross had ascended Starr King Mountain, and later he made an independent trip to Lunenburg Heights, Vermont. After he left me, I obtained aneroid readings for Boy Mountain, Bray Hill, the Mt. Adams House, and Pleasant and Prospect Hills near Lancaster.

1877. For the three weeks preceding August 1st, Prof. Cross and myself were together at the Goodnow House, Sugar Hill. Instruments, the aneroid of the preceding year and a mercurial barometer by Green of New York. Full series of observations were made, connecting Goodnow's with Littleton, Lisbon, Bethlehem Depot, and the Profile House; the height of Bethlehem Street was redetermined, and the more important points on the road from Littleton to the Franconia Notch were carefully fixed. Between Goodnow's and the Profile House, eight sets of measurements were made, with readings at five intermediate stations. We also determined the heights of Sugar Hill, Wallace Hill, Bald Mountain, Mts. Lafayette and Lincoln, Profile Mountain, and Lonesome Lake. In the case of

Profile Mountain, we found that the path from the Profile House terminates upon a minor summit, 250 feet below the highest peak. To this minor summit we propose to restrict the name of Cannon Mt. July 25th we ascended Mt. Washington, and in the afternoon took readings upon Nelson's Crag and the Lion's Head Cliff. The next day we descended by the Crawford Bridle Path, taking observations with both aneroid and mercurial at the summits of Monroe, Franklin, Pleasant, and Clinton. The aneroid was read at other intermediate stations, and thus a series of measurements was secured referable to both the Crawford House and the Summit, two points of known altitude. By means of a pocket level, Prof. Cross was also able to get an estimate for the elevation of Boott's Spur.

On the 1st of August, we quitted Sugar Hill and went together to Sanborn's hotel, West Campton. Prof. Cross remained with me for a week, and then went elsewhere. I stayed four weeks longer. Together, we climbed Weetamoo, Cooke's Hill, and Black Mountain, and visited the Slide at Waterville. The Black Mountain excursion also gave us measurements upon Jenning's Peak and the summits of the Acteon Range. After Prof. Cross left Campton, I, with various companions, ascended Scar Ridge, Welch Mt., Stone Mt., Green Mt., and the three peaks of the Fisher Range. This name of "Fisher Mt." seems to need some explanation. The farmers in the Millbrook Valley give it to a low rocky crest immediately back of the Elkins Farm; while from the Waterville road it is attached to a much higher summit north of Stone and next west of Green Mt. Between this higher mountain and the other is still a third peak, a spur of which is known as "Hedgehog." In the table of heights the name "Fisher" will be given to the highest peak of the three, "Middle Fisher" to the nameless one, and "Elkins Fisher" to the summit immediately overlooking the Millbrook Valley. These mountains are all spurs of the great Tecumseh group. For Fisher and Green Mts. two sets of measurements were obtained on two separate days. I also reascended Cooke's Hill and Weetamoo, revisited Waterville, climbed Osceola, and

measured several low hills. Along the road from Campton to Waterville, a chain of stations was selected, and at each one numerous observations were taken. Including the work of 1874 and 1875 I have now in all five sets of measurements for the height of Greeley's Hotel, three sets for Cooke's Hill, two for Weetamoo, and two for Osceola. The altitudes of Sanborn's hotel and of Campton Village were fixed by reference to the railroad at Plymouth.

This outline of the work done is necessarily very incomplete. To fully discuss all the important questions involved in it, and to indicate the probable value of each measurement, would require more space than APPALACHIA could well afford to give. Altogether we have on record nearly 700 barometric observations, relating to the height of about 150 different points. For some of these points we have but single barometric differences to compute from; while in other instances elaborate series are available. To determine the height of the Goodnow House, for example, there are over twenty observations of difference of level. A similar number serves to fix the height of Jefferson, and even more relate to Franconia Ironworks. As far as possible, chains of stations have been chosen, preferably between points of known elevation, and by repeated series of readings taken along such chains the heights of many places have been fixed with considerable accuracy. Some of the best work of this kind has been done with the aneroid alone, an instrument which deserves a higher reputation for exactness than is commonly ascribed to it. Our figures afford numerous opportunities for comparing both forms of barometer, and the agreement between them is generally of the closest kind.

In constructing the table of heights, few abbreviations have been used. Those in the first column, serving to indicate the method of measurement, are practically the same as are employed in the reports of the New Hampshire State Geological Survey. Thus A. means aneroid barometer; M., mercurial barometer; and P. L., pocket level. A. M. naturally shows that the determination has been made with *both* barometers, and that the figure given is a mean. For the sake of completeness, the heights are given both in metric and in English

measures; the latter column being for the benefit of readers unfamiliar with the French system, and for convenience of comparison with the results of other investigators. Had it not been for these considerations, the metric column alone would have been furnished. It is hardly necessary to add, that all the measurements are computed as so much above sea-level.

WHITE MOUNTAINS PROPER.

		Meters.	Feet.
M.	Mt. Washington. Summit	1915	6285
A.	" " Nelson's Crag	1711	5615
A.	" " Lion's Head	1529	5016
A.	" " Top of South Wall of Huntington's Ravine	1656	5432
A.	Mt. Madison	1626	5336
A.	Star Lake, between Madison and Adams	1490	4890
A.	Summit of Cliff, head of King's Ravine	1562	5125
A.	Lowe's Mt. Adams Path. House at foot	436	1430
A.	" " " A. M. C. Camp	1008	3307
A.	" " " First Ledge	1323	4342
A.	Mt. Adams. True Peak	1760	5776
A.	" "Sam Adams" Peak	1693	5554
A.	" J. Q. Adams Peak	1641	5384
A.	" "Nowell's Peak"	1619	5313
P.L.	Boott's Spur	1683	5524
A.	Lake of the Clouds	1540	5053
A.M.	Mt. Monroe	1636	5367
A.	"Little Monroe"	1591	5220
A.	Depression between Monroe and Franklin	1518	4980
A.M.	Summit " " "	1531	5022
A.M.	Mt. Franklin	1499	4917
A.M.	Depression between Franklin and Pleasant	1345	4414
A.M.	Mt. Pleasant	1454	4771
A.	Depression between Pleasant and Clinton	1238	4063
A.M.	Mt. Clinton	1314	4311

MISCELLANEOUS MOUNTAINS AND HILLS.

M.	Starr King Mountain. (C. R. Cross)	1202	3943
A.	Owl's Head, Cherry Mountain	1006	3302
A.	Boy Mountain, near Jefferson	694	2278
A.	Mt. Pleasant, Lancaster	578	1896
A.	Mt. Prospect, "	628	2062
A.	Bray Hill, Whitefield	499	1637
A.	Wallace Hill, Bethlehem	647	2124

		Meters.	Feet.
A.M.	Sugar Hill, Lisbon. Coast Survey Signal . .	543	1781
A.	" " True Summit (approximate)	578	1895
A.M.	Bald Mountain, Franconia Notch	704	2310
A.M.	Mt. Lafayette. Highest Peak	1600	5249
A.	" " Lower North Peak	1549	5081
A.M.	" " Eagle Lakes	1264	4146
A.	" " Eagle Cliff Notch	911	2990
A.	Gap between Lafayette and Lincoln . . .	1500	4923
A.	Knob " " "	1531	5024
A.	Mt. Lincoln	1554	5098
P.L.	Mt. Kinsman. Highest summit seen from Lafayette	1332	4370
A.M.	Profile Mountain. True summit	1254	4114
A.M.	" " Summit of path	1178	3865
A.M.	" " Lonesome Lake	838	2751
A.	Signal on Spur of Mt. Deception, opposite Fabyan House	668	2193
A.M.	Mt. Weetamoo, Campton	776	2546
A.M.	Black Mountain (Sandwich Dome). Highest Peak	1241	4071
A.M.	" " Jennings Peak	1093	3587
A.M.	" " Sachem Peak. Higher . .	930	3050
A.	" " " Lower . . .	904	2967
A.M.	" " Middle Acteon Peak . . .	776	2545
A.M.	" " Bald Knob	729	2391
A.M.	Mt. Osceola	1347	4417
A.	Mt. Tecumseh. Highest Peak	1251	4105
A.M.	" " Southwest Shoulder . . .	1182	3878
A.M.	Green Mountain. Tecumseh Group . . .	1081	3547
A.M.	Stone Mountain. " "	1029	3376
A.M.	Fisher Mountain. " "	1058	3470
A.M.	"Middle Fisher." " "	850	2790
A.M.	"Elkins Fisher." " "	799	2621
A.M.	Welch Mountain. Lower Peak	810	2657
A.M.	" " Higher Peak or "Dickey Mt." .	850	2788
A.	Saddle between peaks of Welch Mountain . .	774	2540
A.M.	Scar Ridge, Thornton Gore	1165	3824
A.	Sunset Hill, Campton Village	315	1035
A.	Hill above Red School-house, West Campton . .	326	1070
A.	Rowe's Hill, West Campton	376	1235
A.	Taylor's Hill, "	429	1406
A.M.	Cooke's Hill, "	682	2236
A.	Hill between West Campton and Cox's Hill . .	287	943
A.	Cox's Hill, near West Campton	272	893
A.	Fort Mountain, Epsom	436	1431
M.	Ossipee Mountain. East Knoll (C. R. Cross) .	846	2774
M.	" " Melvin Peak " . . .	899	2950
M.	Gunstock Mountain " .	732	2400

		Meters.	Feet.
M.	Belknap Mt., lower peak of the Twins (C. R. Cross)	688	2259
M.	Piper Mt., lowest peak of the Belknaps "	629	2063

HOTELS, FARM-HOUSES, &c.

A.	Blair's Hotel, West Campton	169	556
A.	Sanborn's Hotel, "	174	571
A.	West Campton Post-Office	190	623
A.	Chase's Hillside House, Campton	197	645
A.	Black Mountain House, "	209	687
A.	Campton Hollow Post-Office (approximate) . .	215	707
A.	Foss's Brook-Farm House, Campton-Waterville road	229	752
A.	Durgin's Boarding-house, " "	298	979
A.M.	Elliott's " " "	316	1036
A.M.	Dolloff's Farm-house, " "	317	1039
A.M.	A. Roby's Farm-house, foot of Mt. Weetamoo path .	378	1240
A.	Rising Sun Church, West Campton	336	1103
A.	High Barn, near top of Cooke's Hill . . .	588	1930
A.M.	Elkins's Farm-house, foot of Mt. Tecumseh . .	373	1225
A.	Isaac Fox's Boarding-house, Woodstock . . .	228	749
A.M.	Last house, Thornton Gore Road	434	1423
A.M.	Greeley's, Waterville	468	1536
M.	Locke's Farm-house, Gilford (C. R. Cross) . .	196	643
A.	M. M. Steele's residence, Epsom	238	781
A.	Oak Hill House, Littleton. Est. from partial meas.	297	975
A.M.	Goodnow House, Sugar Hill	407	1334
A.	Sugar Hill Post-Office	412	1351
A.	Lafayette House, Franconia	302	990
A.	Franconia House, "	321	1054
A.	Profile Farm-house, "	397	1302
A.M.	Sinclair House, Bethlehem	445	1459
A.	Maplewood House, "	451	1489
A.	Dodge's Mountain View House, Whitefield (approx.)	390	1279
A.	Fiske's Cherry-Mountain House, " "	381	1249
A.M.	Starr King House, Jefferson	438	1437
A.	Mt. Adams House, Jefferson	502	1648
A.	Farm-house at foot of Prospect Hill path, Lancaster	399	1310
A.	" " Owl's Head path, Jefferson	440	1442

ROAD SUMMITS, BRIDGES, &c.

A.	Bridge at Livermore Falls (approximate) . .	165	540
A.	" Campton Hollow " . .	201	658
A.	Thornton Bridge	183	599
A.	Woodstock Bridge	202	661
A.	Summit of Middle road, West Campton . . .	338	1108
A.	" Ellsworth road, "	456	1495

		Meters.	Feet.
A.	Usual summit of tourists' drive, Cooke's Hill . .	526	1726
A.	Junction of Sandwich and Waterville roads, Thornton	264	867
A.	Mad River Bridge, Campton-Sandwich road . .	236	774
A.M.	Sandwich Notch, " " " .	535	1754
A.	Summit of road from Campton to Mt. Weetamoo .	410	1344
A.	Mad River Bridge, Campton-Waterville road .	287	943
A.	Summit of Littleton-Franconia stage road . .	415	1360
A.	Bridge at Franconia Iron-works	280	920
A.	Road summit, Franconia Notch	614	2016
A.	Summit of road from Franconia to Bethlehem, near Echo Farm, Wallace Hill, "Breakneck Road" .	529	1737
A.	Summit of Bethlehem-Franconia stage road, by Mt. Agassiz	561	1840
A.	Summit of upper, or western stage road, Bethlehem to Franconia	583	1913
A.	Whitefield-Bethlehem road. Summit . . .	398	1305
A.	" " " Railroad Crossing .	338	1109
A.	" " " Ammonoosuc Bridge	341	1119
A.	Summit of Jefferson and Twin-Mountain House road	511	1676
A.	" Cherry Mountain road . . .	660	2167
A.	" road over Bray Hill, Whitefield . .	435	1428
A.	" Randolph Hill Road, Randolph . .	463	1518
A.	Road summit between Pleasant and Prospect Hills, Lancaster	441	1447
A.	Bridge at Jefferson Mills	311	1022
A.	" Stag Hollow, Jefferson	421	1380
A.	Israel's River Bridge, Jefferson and Twin-Mt. road .	331	1085

MISCELLANEOUS POINTS.

A.	Foot of Waterville Cascades	557	1829
A.	Beckytown clearing, Waterville	573	1881
A.	Foot of Black Rock Cascade, Slide Brook, Waterville	713	2339
A.M.	Foot of steep portion of the Tripyramid Slide . .	905	2969
A.	Foot of Slide on Scar Ridge	687	2255
A.	Clearing between Flume and Profile House . . .	540	1772
A.	Profile Lake	593	1947
A.	Echo "	588	1929
M.	Lunenburg Heights, Vermont (C. R. Cross) .	500	1639

Geodetic Formulæ.

Simplified Methods for Computing Latitude, Longitude, Azimuth, and Distance. With Tables and Examples.

BY J. RAYNER EDMANDS.

Read June 9, 1880.

THE most convenient way of stating the relative positions of a large number of points, either for record or for mapping, is to give their latitudes and longitudes. But other methods have been suggested, mainly to avoid the complicated calculations involved by the fact that the horizontal surface, upon which everything is supposed to be projected, is not plane but spheroidal. Believing that it is desirable to extend the use of latitudes and longitudes, rather than to provide substitutes, the writer has been led to inquire to what extent we may simplify the formulæ, for application to points, where the distances involved are small, and where the accuracy sought is less than that required in primary or secondary triangulation.

The problem is to find the latitude and longitude of a point, the distance and direction of which are given from a point of known latitude and longitude. Various methods have been used, adequate to the needs of the most careful survey; and it is customary for secondary triangulation to omit some of the refinements necessary for long primary lines; but the writer has seen no further simplification, proposed for application to tertiary stations.

Let $K =$ the given geodetic distance between two points; let L and $M =$ the given latitude and the given longitude of the first point; and let $Z =$ the given azimuth of the line passing from the first point to the second, counted from the south around by the west continuously up to 360°. Also let L_1, M_1, and $Z_1 =$ respectively the required latitude, longitude, and azimuth for the second point; let L_0 and $M_0 =$ respectively the latitude and longitude of a point midway between the two; and let $Z_0 =$ the azimuth of the line at that middle point toward the second point. Finally let $\Delta Z = Z_1 - Z \pm 180° =$ the variation of the azimuth of the line in moving from the first point to the second. Distances are to be expressed in meters, and differences of latitude, longitude, or azimuth in seconds of

arc. North latitude and west longitude are to be taken positive, and remarks as to sign apply only to the northern hemisphere in west longitude.

According to the equation recommended by Prof. J. E. Hilgard for use in the secondary triangulation of the U. S. Coast Survey,[1] the difference in latitude between the middle point and the second point would be,

$$L_0 - L_1 = B_0 \frac{K}{2} \cos Z_0 + C_0 \frac{K^2}{4} \sin^2 Z_0 + D_0 \left(B_0 \frac{K}{2} \cos Z_0\right)^2$$

where B_0, C_0, and D_0 are values corresponding to the latitude of the middle point, and given in tables published by the Coast Survey. Similarly, for the difference in latitude between the middle point and the first point, we should have

$$L_0 - L = - B_0 \frac{K}{2} \cos Z_0 + C_0 \frac{K^2}{4} \sin^2 Z_0 + D_0 \left(B_0 \frac{K}{2} \cos Z_0\right)^2$$

The difference of these two equations gives, for the difference in latitude between the first and the second point,

$$L - L_1 = B_0 K \cos Z_0, \qquad (1.)$$

the device of resorting to the middle point having secured the elimination of the other terms. As B_0 and K are always positive, the sign of $(L - L_1)$ will be that of $\cos Z_0$.

For the difference in longitude between the first and the second point, we may use the formula recommended for the secondary triangulation of the Coast Survey,

$$M_1 - M = \frac{A_1 K \sin Z}{\cos L_1}, \qquad (2.)$$

where A_1 is a value corresponding to the latitude of the second point, and given in the tables. As A_1, K, and $\cos L_1$ are always positive, the sign of $(M_1 - M)$ will be that of $\sin Z$.

Treating this similarly to the difference of latitude, we should have

$$M_0 - M_1 = \frac{A_0 K \sin Z_1}{2 \cos L_0}, \text{ and } M_0 - M = \frac{A_0 K \sin Z}{2 \cos L_0},$$

where A_0 is the tabular value corresponding to the latitude of the middle point. Subtracting, and taking $\frac{1}{2} (\sin Z - \sin Z_1) = \sin Z_0$, very nearly, we then have,

$$M_1 - M = \frac{A_0 K \sin Z_0}{\cos L_0}. \qquad (3.)$$

[1] Report for 1860, Appendix No. 86; again in Report for 1875, Appendix No. 19.

For the quantity Δ Z, the formula recommended for the secondary triangulation of the Coast Survey is

$$-\Delta Z = (M_1 - M) \sin \tfrac{1}{2} (L + L_1). \qquad (4.)$$

But we may write without sensible error, $\sin \frac{1}{2} (L + L_1) = \sin L_0$, and substituting also the value of $(M_1 - M)$ given by (3), we have very nearly

$$-\Delta Z = K \sin Z_0 \cdot A_0 \tan L_0. \qquad (5.)$$

The quantity given by (4) or by (5) is called *the convergence of the meridians.* According to (4) it equals the difference of longitude, multiplied by a factor corresponding to the latitude. The following table gives the values of this factor for six latitudes.

Latitude.	Factor.	Latitude.	Factor.
23° 35′	0.4	44° 26′	0.7
30° 00′	0.5	53° 08′	0.8
36° 52′	0.6	64° 09′	0.9

The sign of Δ Z is opposite to that of $(M_1 - M)$, so that the numerical result of (4) or (5) will be subtracted from that of (2) when the second point is farther west than the first, and added when the second point is the farther east.

The calculation may be made in the following manner. Estimate the mean latitude L_0 and also the difference in longitude $(M_1 - M)$. With these, estimate the convergence of the meridians by aid of the remarks following (5). Half of this convergence added to Z (or subtracted from it, as the case may be) gives an estimate of Z_0. With these estimates solve (5), using $\log A_0 = 8.509$, or taking its value from the tables which accompany this paper, when four places are desired. Half this result added to or subtracted from Z (as the case may be) gives a sensibly accurate value of Z_0. With this solve (1), consulting the tables for the value of B_0 corresponding to the estimate of L_0. Finally solve (2), taking A_1 from the tables. A map will aid in the estimates, even when one locates the point upon it by the eye.

When the distance is short, and the point is already mapped with a fair degree of accuracy, first solve (4), using L_1 and M_1 as derived from the map, and then solve (1) and (3). The use of (3) instead of (2) will enable the constants and the trigo-

nometrical functions of Z to be taken from tables, for (1) and for (3) simultaneously; but a new value of L_0 should be used in (3), derived from that of L_1 just calculated.

When the distance is long, and no good estimate of M_1 is to be had, first solve (2) or (3) approximately. With this as an estimate of M_1, proceed as directed at first. A case might arise calling for a similar preliminary solution of (1).

Should ΔZ be wanted for its own sake with greater accuracy, make a final solution of the equation,

$$-\Delta Z = (M_1 - M) \frac{\sin \frac{1}{2} (L + L_1)}{\cos \frac{1}{2} (L_1 - L)}.$$

The tables give the logarithms of A, the number of seconds per meter in length of arc of the prime vertical (or section of the earth perpendicular to the meridian), and of B, the number of seconds per meter in length of arc of the meridian. They are derived from the voluminous tables published by the U. S. Coast Survey,[1] applying the corrections there tabulated for converting from the Bessel spheroid to that derived by Col. A. R. Clarke, of the Royal Engineers, embodying the results of additional measurements. Bessel's terrestial elements were considered to be subject to an uncertainty of nearly 500 meters in the quadrant, or 1 in 20,000, which would correspond to an uncertainty of about two units in the fifth decimal place of logarithms. This agrees with the correction made in the length of arc of meridian in low latitudes; but for latitude 60° the correction amounts to about six units in the fifth decimal place of the logarithms, which is also roughly that to which the length of arc of the prime vertical has been subjected throughout. From this, it would appear that, except for special geodetic purposes, the use of the sixth place in the logarithms would be assuming a better knowledge of the dimensions of the earth than can be asserted to exist.

The arrangement of the tables is, perhaps, original. The values of the logarithm progressing regularly by five in the fifth place, the tables give not only the latitude corresponding to each four-place logarithm, but also the limits of latitude within which the latter is the nearest four-place value. The third column gives the number of units difference in the fifth

[1] To eight decimal places in the Report for 1860, and to seven in that for 1875.

place of the logarithm per minute of latitude, to aid in interpolating. Thus, while especially adapted to four places, the tables are convenient for five, and available to six.

In regard to the accuracy of the formulas, notice that (2) and (4) are identical with those recommended for the secondary triangulation of the Coast Survey, that (1) is at least as accurate as the one there recommended, and that the approximations by which (3) and (5) were obtained, and by which Z_0 is taken equal to $Z + \frac{1}{2} \Delta Z$, introduce errors which are inappreciable on account of the small magnitudes of ΔZ and of the distances for which (3) is recommended. Moreover (4), used by the Survey, is itself an approximation.

It remains to consider the accuracy with which the method can be carried out. An error as large as 0°.2 in the estimate of L_1 (0°.1 in L_0) will not seriously affect the logarithms of A_1 and B_0 in the fifth place. An error of 2′ in the estimate of L_1 or of ΔZ (1′ in L_0 or in $\frac{1}{2} \Delta Z$) will hardly cause an error of 1″ in ΔZ as obtained from (5), where the difference of longitude does not exceed a degree; and only half this error enters (1) or (3). Equation (2) involves no estimates. An error of 20″ in the value of M_1 derived from a map, will give ΔZ by (4) within less than 20″, which gives Z_0 within less than 10″ for use in (1) and (3). This last is all that is required for short distances, besides being as accurate as is called for by the character of many of the angular observations. Equations (1) and (2) should be solved with five-place logarithms, when it is desired to be accurate to one or two hundredths of a second of latitude and longitude with values of $(L - L_1)$ and $(M_1 - M)$ ranging from 1′ to 15′.

The equations are readily adaptable to calculating the azimuth when the positions of the two points are given. An interesting case calling for such a solution arose in running the Canadian boundary in 1845, when parties began at each end of a line to cut through the forest a distance of more than a hundred kilometers (about sixty-four miles), the directions having been calculated by Mr. Airy, the Astronomer Royal.

Dividing (3) by (1) and solving for $\tan Z_0$, we have

$$\tan Z_0 = \frac{B_0}{A_0} \cdot \frac{(M_1 - M) \cos L_0}{L - L_1}. \qquad (6.)$$

To calculate, solve (4) and (6) independently, and take

$$Z = Z_0 - \tfrac{1}{2} \varDelta Z \text{ (very nearly).} \qquad (7.)$$

B_0 and A_0 are to be taken from the tables which accompany this paper.

This method is sufficiently accurate for most cases, especially if $(L - L_1)$ or $(M_1 - M)$ be small. When neither of these is small, a method previously proposed[1] by the writer is more accurate. An established formula for azimuth[2] may be put in the form

$$\cot Z = \frac{A}{B} \cdot \frac{L - L_1}{(M_1 - M) \cos L_1} - (M_1 - M) \cos L_1 \tan L \frac{\sin 1''}{2} \qquad (8.)$$

Writing $\cot (z + \delta) = \cot z - \frac{\sin 1''}{\sin^2 z} \delta$ (where δ is an increment of arc), equating the terms placed under each other in the two equations, and solving for δ, we have very nearly

$$Z = z + \delta \ (9), \text{ where } \tan z = \frac{B}{A} \cdot \frac{(M_1 - M) \cos L_1}{L - L_1}. \qquad (10.)$$

$$\text{and } \delta = \tfrac{1}{2} (M_1 - M) \cos L_1 \tan L \sin^2 z. \qquad (11.)$$

The nature of the second term of (9) may be exhibited by overlooking the distinctions between L and L_1 in (11), and substituting (4) therein. Thus we have approximately

$$\delta = - \tfrac{1}{2} \varDelta Z \sin^2 z. \qquad (12.)$$

To calculate, solve (10) and look out sin z at the same time with z; then solve (11); and finally (9). As $\sin^2 z$ is always positive, the sign of δ is the same as that of $(M_1 - M)$.

Some care is necessary in solving (7) or (9) to place Z_0 or z in the right quadrant *before* applying the second term. The accompanying table will aid.

Quadrant.		$L - L_1$.	$M_1 - M$.
I.	0° to 90°	+	+
II.	90° " 180°	—	+
III.	180° " 270°	—	—
IV.	270° " 360°	+	—

The second terms of (7) and of (9) are to be numerically added when the second point is farther west than the first, and

[1] Appalachia, Vol. II. p. 38. Cos L is there erroneously printed cot L.

[2] See "Tables and Formulas," Professional Papers of U. S. Corps of Engineers, No. 12, p. 96.

numerically subtracted when it is the farther east. A mistake in the sign of the second term will have the same effect in (8) as in (9), so that the two cannot be used to check each other. But (7) and (9) may be so used, unless the line run nearly east and west, when $\sin^2 z$ will be too near unity to make any marked difference between the respective second terms.

The distance is also readily obtainable in terms of the latitude and longitude. Dividing (1) by B_0, multiplying (3) by $(\cos L_0 \div A_0)$, squaring both equations, adding them, and remembering that $\sin^2 z_0 + \cos^2 z_0 = 1$, we have nearly

$$K^2 = \left[\frac{L - L_1}{B_0}\right]^2 + \left[\frac{(M_1 - M) \cos L_0}{A_0}\right]^2. \quad (13.)$$

The error of (13) will not exceed that due to making the calculation with five-place logarithms, except in the case of desiring the distance between very remote points.

The direct calculation of azimuth and distance, by means so simple, will sometimes save recourse to the solution of triangles, in which two sides and the included angle are the given data, — a form of solution which is relatively slow, besides employing quantities not always published. The failure of the method to apply in many instances will be due, not to inaccuracies in the simplified equations, but to the fact that the differences of latitude and longitude often are not known with an accuracy comparable to the distances and angles of the triangulation.

In conclusion we would justify the use of simplified formulas for the tertiary lines of a survey by quoting a remark of Capt. John Herschel's.[1] In the course of a review of Col. Clarke's recent work on "Geodesy," he says: "Let it be remembered that the accuracy insisted on in trigonometrical surveying operations and reductions is far greater than is required for fiscal, commercial, or what are commonly called practical purposes. The object of this exceeding accuracy is geodetical. Thus, for instance, no one would dream of surveying a small isolated island with such accuracy. A great part of the cost of a continental survey, therefore, has to be reckoned as sunk for the sake of ultimately learning more about the exact shape of the earth than we could at present see any direct utility in."

[1] Nature, Vol. XXI. p. 608.

CURVATURE OF

A = Curvature of Prime Vertical, in seconds per meter.

B = Curvature of Meridian, in seconds per meter.

Prime Vertical.			Meridian.		
Latitude.	Log A.	Diff. per 1'.	Latitude.	Log B.	Diff. per 1'.
° '			° '		
23 07	8.50950	—.032	23 03—	8.51200	—.094
25 42	945	.034	23 56	195	.096
28 07	940	.036	24 48	190	.099
30 24	935	.038	25 38+	185	.101
32 35	930	.040	26 28—	180	.103
34 41	925	.041	27 16	175	.106
36 44	920	.041	28 03+	170	.107
38 45	915	.042	28 50	165	.110
40 44	910	.043	29 35+	160	.111
42 41	905	.043	30 20+	155	.113
44 37	900	.043	31 05—	150	.114
46 34	895	.043	31 48+	145	.115
48 31	890	.042	32 32—	140	.117
50 29	885	.042	33 14+	135	.118
52 29	880	.041	33 57—	130	.119
54 31	875	.040	34 38+	125	.121
56 36	870	.039	35 20—	120	.122
58 44	865	.037	36 01—	115	.122
60 58	860	.035	36 42—	110	.124
63 19	855		37 22	105	.125

The value of + or — after the minutes of latitude is ⅓ of 1',

TERRESTRIAL ARCS.

Clarke's Elements { Equatorial Semi-axis = 6 378 206.4 meters.
Polar Semi-axis = 6 356 583.8 meters.

Meridian.

Latitude.	Log B.	Diff. per 1′.	Latitude.	Log B.	Diff. per 1′.
° ′		—.125	° ′		—.126
38 02	8.51100		51 06	8.51000	
		.125			.126
38 42	095		51 46—	.50995	
		.126			.124
39 22—	090		52 26	990	
		.126			.124
40 01+	085		53 06+	985	
		.127			.123
40 41—	080		53 47	980	
		.127			.123
41 20	075		54 28—	975	
		.128			.121
41 59	070		55 09	970	
		.127			.121
42 38+	065		55 50+	965	
		.129			.119
43 17	060		56 32+	960	
		.128			.118
43 56	055		57 15—	955	
		.128			.116
44 35	050		57 58—	950	
		.129			.115
45 14—	045		58 41	945	
		.128			.114
45 53—	040		59 25	940	
		.128			.112
46 32—	035		60 10—	935	
		.129			.110
47 10+	030		60 55	930	
		.128			.109
47 49+	025		61 41	925	
		.128			.107
48 28+	020		62 28—	920	
		.127			.104
49 08—	015		63 16—	915	
		.127			.103
49 47	010		64 04+	910	
		.127			.100
50 26+	005		64 54+	905	
		.126			

e. g. 3′— and 38′+ respectively equal 2′ 40″ and 38′ 20″ more nearly.

Ex. 1. *Latitude, Longitude, and Convergence of Meridians.*[1]

(*Given*) Agamenticus,	$L = 43^\circ\ 13'\ 23''.18$	$M = 70^\circ\ 41'\ 31''.88$
(*Req'd*) Isles of Shoals,	$L_1 = 42^\circ\ 59'\ 13''.32$	$M_1 = 70^\circ\ 36'\ 49''.23$
	$[L - L_1] = +0^\circ\ 14'\ 9''.86$	$[M_1 - M] = -0^\circ\ 4'\ 42''.65$
(*Given*) Agam. to I. of Shoals,	$K = 26990^m.7$	$Z = 346^\circ\ 16'\ 38''.5$
(*Req'd*) " " "	$\Delta Z = +3'\ 13''.1$	

Above values of L_1, M_1, and ΔZ being unknown as yet, assume $L_0 = 43^\circ\ 00'$ and $(M_1 - M) = -100''$ roughly, whence $\Delta Z = -\frac{2}{3}(M_1 - M) = +67''$ roughly, $\therefore\ \frac{1}{2}\Delta Z = +33''$

Whence for use in (5), $Z_0 = \text{(about) } 346^\circ\ 17'$

Convergence by Equation (5).

Without regarding signs of each of these quantities, take ΔZ positive, since $(M_1 - M)$ is negative.

$\log K$	4.431
$\log \sin Z_0$	9.375
$\log A_0$	8.509
$\log \tan L_0$	9.970
$[\log \Delta Z]$	2.285

Whence by (5), $\Delta Z = +193'' = +3'\ 13''$

$Z = 346^\circ\ 16'\ 38''.5$

$\frac{1}{2}\Delta Z = \frac{1}{2}(3'\ 13'') = +1'\ 36''.5$

Whence for use in (1) $Z_0 = 346^\circ\ 18'\ 15''$

L_1 being as yet unknown, use also in (1) the estimate $L_0 = 43^\circ\ 00'$.

Latitude by Equation (1).

$\log B_0$	8.51062
$\log K$	4.43121
$\log \cos Z_0$	9.98747
$[\log (L - L_1)]$	2.92930

$(L - L_1)$ positive since $\cos Z_0$ is positive.

L	$43^\circ\ 13'\ 23''.18$
$-(L - L_1 = 849''.77) =$	$-\ 14'\ 09''.77$
	$L_1 = 42^\circ\ 59'\ 13''.41$

Longitude by Equation (2).

$\log A_1$	8.50904
$\log K$	4.43121
$\log \sin Z$	9.37515
	2.31540
$\log \cos L_1$	9.86422
$[\log (M_1 - M)]$	2.45118

$(M_1 - M)$ negative since $\sin Z$ is negative.

$(M_1 - M) = -282''.60 = -4'\ 42''.60$

The differences of latitude and longitude of the Coast Survey figures exceed those just obtained by $0''.09$ and $0''.05$ respectively. This is accounted for by the fact that the former are based upon the Bessel ellipsoid. According to the table[2] given by Prof. Hilgard for converting arcs of the Bessel into those of the Clarke ellipsoid, $0''.084$ and $0''.042$, in this

[1] Data furnished by Capt. C. P. Patterson, Supt. U. S. Coast Survey. See Hitchcock's "Geology of New Hampshire," Vol. III. Part III. p. 375.

[2] U. S. Coast Survey Report for 1875, p. 367.

case, should be numerically subtracted respectively from the former to give the latter. The calculation, therefore, checks within 0″.01 of latitude and longitude, and within 1″ of back azimuth (Z_1), although the difference of latitude is greater than that for which five-place logarithms can generally be relied on to give this accuracy.

Ex. 2.[1] *Latitude and Longitude for Short Distances.*

(*Given*) Powderhorn,	$L = 42°\ 24'\ 02''.71$	$M = 71°\ 01'\ 30''.95$
(*Req*) Boston State Ho.,	$L_1 = 42°\ 21'\ 27''.61$	$M_1 = 71°\ 03'\ 30''.00$
	$[L - L_1] = +0°\ 02'\ 35''.10$	$[M_1 - M] = +0°\ 01'\ 59''.05$
(*Given*) Powderhorn to B. St. Ho.	$K = 5505^m.9$	$Z = 29°\ 39'\ 10''$

Above values of L_1 and M_1 being unknown as yet, estimate from a map[2] $L_0 = 42°\ 22'.8$ and $M_1 = 71°\ 04'.0$, whence $(M_1 - M) = +149''$ and by (4) $\Delta Z = -.674 \times 149 = -100''$ $\quad\therefore\ \frac{1}{2}\Delta Z = \quad -50''$

Whence for use in (1) and (3) $\quad Z_0 = 29°\ 38'.3$

Latitude by Equation (1).

$\log B_0$	8.51067
$\log K$	3.74083
$\log \cos Z_0$	9.93910
$[\log (L - L_1)]$	2.19060

$(L - L_1)$ positive since $\cos Z_0$ is positive.

$(L - L_1) = +155''.10 = +2'\ 35''.10$

$\therefore\ L_0 = \quad 42°\ 22'\ 45''$

Longitude by Equation (3).

$\log A_0$	8.50906
$\log K$	3.74083
$\log \sin Z_0$	9.69419
	1.94408
$\log \cos L_0$	9.86847
$[\log (M_1 - M)]$	2.07561

$(M_1 - M)$ positive like $\sin Z_0$.

$M_1 - M = +119''.02 = +1'\ 59''.02$

According to the Coast Survey tables already referred to, 0″.015 and 0″.018 should be numerically subtracted respectively from the Coast Survey values of $(L - L_1)$ and $(M_1 - M)$, to reduce them to the Clarke ellipsoid, before comparing our results with them. This apparently places the errors of the calculation between 0″.01 and 0″.02, but it would require the correct results carried to thousandths in order to tell by comparison whether our error actually exceeds or falls within 0″.01. Notice that the result will not be changed by a second solution with revised constants.

[1] Data from Report of U. S. Coast Survey, 1864, p. 168.

[2] Simeon Borden's Topographical Map of Massachusetts, 1844.

Ex. 3. *Azimuth by Equations* (4), (6), *and* (7).[1]

(*Given*) Mt. Pleasant, Me., $L = 44° 01' 35''.17$ $M = 70° 49' 00''.88$

(*Given*) Ragged Mount, $L_1 = 44° 12' 43''.97$ $M_1 = 69° 08' 43''.54$

$-0° 11' 08''.80$ $-1° 40' 17''.34$

$[L - L_1] = -668''.80$ $[M_1 - M] = -6017''.34$

(*Required*) $Z = 260° 38' 52''.3$ $Z_1 = 81° 48' 41''.6$

$\frac{1}{2}(L + L_1) = 44° 07' 09.''57 = L_0$ very nearly.

$\log \sin \frac{1}{2}(L + L_1)$	9.8427	$\log (B_0 \div A_0)$	0.00152
$\log (M_1 - M)$	3.7794	$\log (M_1 - M)$	3.77940
$[\log \Delta Z]$	3.6221	$\log \cos L_0$	9.85606
ΔZ positive since $(M_1 - M)$ is negative.			3.63698
		$\log (L - L_1)$	2.82530
$\Delta Z = +4189'' = +1° 09' 49''$		$[\log \tan Z_0]$	0.81168

$$Z_0 = 261° 13' 46''$$
$$\mp \tfrac{1}{2}\Delta Z = \mp 0° 34' 54''$$
$$Z = 260° 38' 52'' \qquad Z_1 = 81° 48' 40''$$

The data are not sufficiently precise to test the agreement of the calculation within a single second of the azimuths given by the Coast Survey.

Ex. 4. *Distance by Equation* (13).[2]

$L = 43° 13' 23''.18$ $-\frac{1}{2}(L - L_1) = -424''.88$

$L - L_1 = +849''.77$ $\therefore L_0 = 43° 06' 18''$

$\log (L - L_1)$	$= 2.92930$	$\log (M_1 - M)$	$= 2.45118$
$\log B_0$	8.51061	$\log \cos L_0$	9.86338
	4.41869		2.31456
	2	$\log A_0$	8.50904
$\left[\log \left(\frac{L - L_1}{B_0}\right)^2\right]$	8.83738		3.80552
			2
[Gauss]	0.02505	$\left[\log \left(\frac{(M_1 - M)\cos L_0}{A_0}\right)^2\right]$	7.61104
$[\log K^2]$	8.86243		8.83738
$\log K$	$= 4.43121$	[Argument for Gauss.]	8.7737

The logarithm of K^2 is derived directly from the logarithms of the separate terms by Gauss's "Addition-Logarithms." When unprovided with such tables, the natural numbers must be taken out for each term, and added to get K^2. The calculated five-place value of log K agrees with that used in Ex. 1.

In the foregoing examples brackets have been used when there has been occasion to denote the meaning of *calculated* figures other than the results sought.

[1] Data from Coast Survey Report for 1853, p. 20*.

[2] Data, the Coast Survey latitude of Agamenticus, and the logarithms of the differences of latitude and of longitude, calculated in Ex. 1.

Distant Points visible from Mount Washington.

BY W. H. PICKERING.

THE first article on this subject appeared in APPALACHIA, Vol. I. p. 86. Especial attention has since been paid to the northeastern horizon, of which little was then known. A profile and map of this region have also been added. (Pl. IV.,V.) In describing the situation of each point, its distance and true bearing or angular position are given. Hence, if the points are identified by means of a compass, allowance must be made for the deviation of the needle, which amounts to 13° west at Mt. Washington. For the benefit of those unfamiliar with such matters it may be noted that sunrise is the best time to observe the eastern, and sunset the western horizon; and that during the middle of the day, which is the time usually selected by tourists, very little can be seen that is more than sixty miles distant. June is the best time to be on the mountain, and September the next. To make sure of a clear afternoon and evening, wait till after a heavy storm. If this clears off at sunset, the higher peaks are pretty sure to be clouded the next morning, and then is the time to start, for the clouds will disperse in the afternoon and give a fine sunset.

The following list, a revision of that of the previous paper, includes the more interesting distant objects which are visible on a very clear day: —

(1.) Mt. Megantic, 86 miles, N. 1° W., and one third of the way from Mt. Jefferson to Mt. Adams. Height, about 3000 ft. It is situated on the boundary line between the towns of Bury and Hampden, in Canada, in a comparatively level region.

(2.) Mt. Carmel, 65 miles, N. 12° E., and just over Mt. Adams. It is very near the northern boundary of Maine, and is readily recognized by the steep slope on the eastern side.

(3.) "Me. B 1.," 105 miles, N. 34° E. (Pl. IV.) This is a fine, but apparently nameless, rocky mountain, rising high above the surrounding region. It must be one of the highest in Maine.

(4.) Saddleback, 60 miles, N. 40° E. Height, 3700 ft. A

magnificent saddle-shaped mountain, situated at the head of the Rangeley Lakes. From it a most exquisite view is to be obtained, similar in some respects to that from Sandwich Dome (Black Mountain). It is not seen to advantage from this point.

(5.) Mt. Abraham, 68 miles, N. 47° E. Height, 3400 ft. For many years it was supposed that Mt. Katahdin, the highest mountain in Maine, was visible from Mt. Washington, and it was pointed out to visitors in numerous directions. From Plate IV. it will be seen that Mt. Abraham lies directly in the way, and it can be shown that, in order to be visible, 2000 ft. would have to be added to the height of Mt. Katahdin. The line from Washington to Katahdin, after crossing the ridge of Abraham, passes for a long distance over a very high and mountainous country, at an elevation of only 2100 to 2500 feet above the sea. Accordingly, if under conditions of extraordinary refraction and clearness combined a distant mountain should be seen in the nearly right direction, it probably would not be Katahdin, but one of the lower and nearer summits about the southern end of Moosehead Lake. Indeed, it is very doubtful if Katahdin is visible from the summit of Abraham itself.

(6.) Ebene Mountain, 135 miles, N. 50° E. It is seen rising over a valley in the Russell Mountains, 103 miles distant, which are themselves seen through a depression in the nearer horizon. This is the most distant point yet identified from Mt. Washington. On the only occasion that I have seen it, it was so minute as to be invisible to the naked eye, although coming out clearly with a small telescope. It is brought up into view solely by atmospheric refraction, and upon this varying factor its apparent size depends. It lies to the south of and beyond Moosehead Lake, its exact position being undetermined.

(7.) Mt. Blue, 57 miles, N. 56° E. Height, 2700 ft. This is a conspicuous pyramidal peak near Farmington, Maine, and a primary station of the U. S. Coast Survey.

(8.) Lake Sebago, 43 miles, S. 51° E., and over the northern summit of Doublehead. It is fourteen miles long by eleven broad.

(9.) The city of Portland, 67 miles, S. 51° E., and situ-

ated just over the right-hand end of the broadest portion of Lake Sebago. It appears as a low white hill, with a long light blue line beyond it. With a telescope the hill resolves itself into a mass of closely packed white houses, and the blue line is seen to be thickly studded with sails. The ocean, however, is not so often seen as are some more distant objects in other directions, partly on account of the difficulty of distinguishing distant water, and partly because the atmosphere in this direction is generally somewhat thicker than elsewhere.

(10.) Mt. Agamenticus, 79 miles, S. 23° E., rather more than two thirds of the way from Kearsarge (North) to Moat, and just over White Horse Ledge. It appears as a flat rounded hill, but slightly projecting above the more distant horizon, and is situated near York, in the southern part of Maine. It forms a conspicuous land-mark for sailors.

(11.) The Isles of Shoals, 96 miles, S. 21° E., situated on the horizon just to the right of Agamenticus. They are perhaps the most rarely seen of all the objects visible from Mt. Washington.

(12.) The Uncanoonucs, 90 miles, S. 10° E., and just over the left shoulder of Passaconaway. Twin summits near Manchester, N. H.

(13.) Joe English Hill, 93 miles, S. 12° W., and noticeable as lying half-way between Passaconaway and Whiteface.

(14.) Mt. Monadnock, 104 miles, S. 23° W., and one fourth of the way from Sandwich Dome to Mt. Carrigain. Height, 3150 ft. It is situated in the southwestern part of New Hampshire, and appears as a very regular rounded summit.

(15.) Mt. Kearsarge (South), 67 miles, S. 24° W., and nearly half-way from Sandwich Dome to Carrigain. In shape it somewhat resembles the latter mountain. Just over its right shoulder is seen the Nelson Pinnacle, 97 miles distant.

(16.) Mt. Ascutney, 81 miles, S. 45° W., and nearly over Mt. Carr if it is visible. It is situated in Windsor, Vermont, near the Connecticut River.

(17.) The Killington Peaks, 88 miles, S. 59° W., and on the horizon between Moosilauke and Lincoln. Twin peaked summits near Rutland, Vermont. Individually the southern one is known as Killington, and the northern as Pico.

(18.) Camel's Hump, 78 miles, N. 87° W., over Bethlehem Street and slightly to the left of Fabyan's. Height, 4100 ft. This is one of the highest of the Green Mountains, and it has a very striking appearance, being shaped like a truncated cone with very steep sides. It is readily visible at sunset on a clear day.

(19.) Mt. Whiteface, 130 miles, N. 86° W., and rising just over the right-hand slope of Camel's Hump. Height, 4900 ft. It is one of the highest of the Adirondacks. Two lower peaks are seen to the right, and three more some distance to the left. These have not yet been identified, but if Mt. Marcy and any of the other higher summits of the Adirondacks are visible, they should appear about 7° to the south of Whiteface, and nearly over the Fabyan House.

(20.) Mt. Mansfield, 77 miles, N. 76° W., and between the Twin-Mountain House and Mt. Deception. Height, 4400 ft. This is the highest of the Green Mountains, and appears as a long ridge bearing a fancied resemblance to the human face.

Description of Plate IV.

The two profiles here represented show nearly all of the mountainous region of Maine that is visible from the White Mountains. The names are so arranged that the most distant points are placed in the upper lines and the nearer ones in the lower. Several of the mountains neither have any names (so far as can be determined) nor are their positions indicated on any map hitherto published. In these cases they are designated by a system of symbols similar to that employed for the New Hampshire Mountains. In cases where the name is uncertain, the symbol is also given. Immediately after the name or symbol follows a figure indicating the distance in miles from the view point. Below each profile is placed a scale on which the south is 0 or 360°, the west 90°, the north 180°, and the east 270°.

Description of Plate V.

The observations on which this map is based were obtained largely in the summer of 1877, when an excursion was made to the vicinity of Phillips, Me. Numerous other observations

have, however, since been added, — the stations occupied being Mts. Washington, Moriah, Kearsarge (North), Blue, Abraham, and Saddleback. The instruments employed were a theodolite and a tangent-table of very light weight and portable form, an original invention in general resembling a plane-table. Small angles are measured with the tangent-table as accurately as they can be drawn, and in no case should the error exceed a tenth of a degree. I am indebted to Mr. J. R. Edmands for profiles drawn with his camera, from which measurements were made in which the error should not exceed three to six minutes of arc. For close interpolations hand profiles were also sparingly resorted to, but chiefly for purposes of identification. Most of the New Hampshire summits lying west of the line joining Hayes and Kearsarge were taken directly from Mr. Henck's map, APPALACHIA, I., Plate I. Thanks are due to Prof. E. T. Quimby for assistance in determining certain positions. The names of the mountains and the positions of the rivers and towns are taken from the county maps. To designate the mountain summits different methods have been employed, dependent on the accuracy of their determination. A triangle designates that the point is a Coast Survey station; a complete circle, that the position of the summit is determined within one millimeter on the scale of the map; a dotted circle, that it lies within three or four millimeters; and the name without other mark, that the position is uncertain, but probably lies near the capital letter. The dotted circle usually indicates that the mountain was observed from one direction only, or that there was a question of identity. In the cases where the name only is used, the mountain generally consists of a low and inconspicuous summit which was not observed at all, but whose position is taken from the county map. Towns and hotels are represented by small rectangles. Many of the summits located had no names so far as could be determined, and they were therefore in all cases indicated by a system of nomenclature identical with that employed by the Club in the case of New Hampshire. The State has been divided into twenty-six sections, to which the letters of the alphabet have been respectively applied; and the mountains in each section, where sufficiently well known,

have received certain numbers. The individual peaks of these mountains are then denoted by secondary numbers, separated from the preceding by a period. Thus, J 8. means Mt. Abraham, but J 8.1 means a summit of Mt. Abraham, the .1 generally, though not necessarily, indicating the highest.

Secretary's Report for 1879.

It is the Secretary's pleasant duty to report a year of more than usual prosperity in the life and work of the Club. The membership of the Corporation has increased from 164, as reported a year ago, to 235 members now in good standing, of whom two are life members. There are besides these 18 members who are more or less in arrears, and 16 who have been elected but have not yet complied with the requirements of the By-Laws, and are therefore not enrolled as members. If we consider only members in good standing our numbers have increased by about 43 per cent. during the year. It is to be noted too that of the total number of persons elected a much smaller percentage fail to accept membership than formerly, which would seem to show an increasing knowledge and appreciation of the nature and objects of the Club, and an increasing interest in its work, on the part of the general public. The number of Corresponding members is now 28, two having been added during the year, and of Honorary members 9, the same as last year.

There have been held during the year nine regular meetings, three field meetings, and one social soirée, this last having been apparently considered by all concerned a most successful first experiment, and one worthy of continuance as a permanent custom of the Club. Besides which excursions have been made to Prospect Hill, in Waltham, and to Mt. Wachusett, the latter having been the most numerously attended excursion ever made by the Club, having been joined by about 125 persons. Excursions were also made in connection with the field meetings to Mt. Carrigain, from Livermore to Waterville,

and to Tuckerman's Ravine. The party on the last occasion was the largest which the Club has ever led on any similar excursion, numbering about 100 persons. We may fairly suppose that this is the largest number of persons ever collected, in this country at least, for a pleasure excursion involving a climb of 2500 ft. over a mountain foot-path.

The library of the Club has increased considerably during the year, among the most important additions being a number of valuable reports and maps from the Government Surveys.

Through the generosity of members and friends of the Club it has been made possible to issue another number of Appalachia, which could not have been done but for their timely aid. It is much to be desired that this publication should be placed beyond dependency upon oft-recurring subscriptions in its aid, as these must in time become tiresome to those who may for the present be willing to aid us, We can hardly afford to wear out our welcome at the doors of any of our friends by coming too often on such errands, and I would therefore respectfully recommend that an effort be made as soon as possible to put our publications on a permanent footing. Something, it is true has already been done in this direction, but not nearly enough to avoid the necessity of resorting to a special subscription if it be decided to issue another number of Appalachia during the coming year.

But while we have not been quite able to stand alone in all things, I think we must regard the year as having been financially as well as otherwise, an eminently successful one; for, beginning the year with a considerable burden of unpaid bills on our hands, we have not only paid these, but as the Treasurer's Report will show, we have ended it with all bills paid and a considerable balance on hand, while we have found friends in our need who have enabled us, as already mentioned, to continue our publications, and also to make, as has been reported by our Councillor of Improvements, a good showing in the way of works of public use and value.

It is therefore with especial satisfaction, and with congratulations to the Club on its prosperous condition that this report is

Respectfully submitted.

J. B. HENCK, Jr., *Secretary.*

Treasurer's Report for 1879.

The receipts for the year ending Dec. 31st, 1879, were as follows: —

From Balance on hand January 8th, 1879:			
in hands of Committee Ways and Means		$ 15.00	
in hands of Treasurer		36.24	$ 51.24
" admission fees of 74 new members[1] . .	$148.00		
" assessments for 1879 from 128 members .	256.00		
" assessments of previous years . . .	40.00		
" assessments for 1880, in advance . .	4.00	448.00	
" sales of Appalachia by Sec. and Treas. .	119.65		
" " by the publishers[2] .	11.20	130.85	
" donations by three members of the Club, (Miss Ellen J. Baker, Mrs. Jared Sparks, and Mr. Warren Upham), for general purposes	15.20		
" donations by sixteen members and friends of the Club, (Mrs. H. E. Prentiss, and Messrs. Edw. L. Adams, Thos. T. Bouvé, N. Willis Bumstead, John Cummings, Rest F. Curtis, George Dimmock, C. H. Dunham, Geo. B. Inches, Chas. W. Kennard, Geo. G. Kennedy, Wm. H. Niles, F. W. Owen, W. H. Pickering, S. A. D. Sheppard, J. A. White), and their friends, for the publication of Appalachia	84.00		
" donation by the American Institute of Instruction for building a path via Sawyer's River to Mount Carrigain and Waterville	90.00		
" donations by Misses M. F. Littlehale, Lee, and R. B. Anderson, and Messrs. Wentworth, Jas. Schouler, F. H. Burt, J. Richard Carter, Frank Curtis, W. S. Fenollosa, C. E. Gilbert, C. E. Lander, W. H. Pickering, Jno. T. Prince, Sheldon, H. C. Tallman, Jas. L. Wesson, T. F. Wright, and others, through Dr. W. B. Parker, for building a path through Tuckerman's ravine	32.50	221.70	
" interest on Investments		1.90	
Total net receipts for the year		$802.45	802.45
Total			$853.69

[1] Of this amount $54 was for the admission fees of 27 members elected in the latter half of 1879; who are thus exempt, under Art. XIII of the By-Laws, from the annual assessment of 1880.

[2] To Aug. 1st, 1879, only; the account of sales for the last 5 months of the year having been delayed by the destruction of the warehouse of the publishers in Boston in the extensive fire of Dec. 28th, 1879.

The expenditures were as follows:

Paid on account of expenses of the previous year (1878),			
for printing on Appalachia, Vol. I, No. 4. . . .		$ 30.79	
for miscellaneous printing, (including $34.80 for "lists of plants of the White Mountains"). .		75.31	
for stationery, postage, &c.		30.06	$136.16
" for postage, expressage, stationery, &c., in 1879 .			66.37
" for investment in Suffolk Savings Bank, (permanent fund from life-memberships received in 1878) .			60.00
" for printing, binding and engraving of Appalachia, as follows, viz:			
Appalachia; Index and Contents of Vol. I. .		17.80	
Appalachia, No. 5 (Vol. II, No. 1)			
printing, &c.	$171.46		
maps	15.00	186.46	
Maps for Appalachia No. 6, (Vol. II, No. 2.) .		7.50	211.76
" for printing and binding by-laws and list of members		23.30	
" for miscellaneous printing, notices of meetings, circulars, &c.		72.64	95.94
" for expenses of Topographical Department for regular transportation of instruments, &c. . .		7.95	
" for extra expenses, repairs, &c.		11.25	19.20
" for record bottles, furnishing and erecting signs, cutting paths and other improvements, (of which $90 was paid for cutting the path to Mt. Carrigain and Waterville). . .			158.76
Total expenses			748.19
Balance on hand December 31st, 1879—			
On deposit in the Cambridge Savings Bank . . .		104.30	
" " " " Suffolk Savings Bank		1.20	105.50
Total			$853.69

The Club thus starts on the New Year free from debt, with a permanent fund of $60, and with $105.50 in cash on hand. There is also due from members for back assessments $46, a part of which will probably not be paid; and for copies of Appalachia delivered to subscribing members about $9. There are also unsold copies of Appalachia on hand, valued at selling prices at about $350; and field instruments which cost about $50.

By a vote of the Council the interest on the Permanent Fund from life-memberships is to remain with it, and accumulate till further orders. The fund and accumulated interest now amount to $61.20. An increase of this

fund from additional life-memberships would be equally advantageous to the Club, and to the contributing life-members.

The amount of current funds which can be kept at interest depends on the promptness of the members in paying their annual dues, and dues for Appalachia. The amount of interest at 4 per cent. which has been lost to the Club during this year by remissness of members in paying their dues is about $6; and during the four years of our existence about $25. Assessments too long in arrears often lead to loss of membership.

To remedy this evil I would respectfully recommend an amendment to the By-laws raising the annual assessment to $2.50; with a discount of 20 per cent. (or half a dollar), to those who pay within three months after the assessment is due; I would also recommend a similar discrimination in favor of subscriptions to Appalachia paid in advance, or on delivery. We shall thus not only draw more interest on our money, but be able to plan our expenditures in advance more wisely with the money *in hand*.

As one of our most important expenditures is for Appalachia, a statement of the cost of each number,[1] and of the part of this cost received back from sales is appended; from this it appears that the average cost of the five numbers already published, with index and contents, is (letter press $147.46, maps $35.40, total) $182.86. The average amount received for sales has been (by Sec. and Treas. $53.13, by Publishers $16.41, total) $69.54; leaving an average deficit on each number of $113.32. I would therefore suggest an early inquiry into the expediency of inviting a cash subscription of $113 or more in aid of publishing the next number.

In view of the small number of copies sold through the publishers, I would also suggest an inquiry whether the sales of Appalachia cannot be increased by adding to its popular features, without lessening its dignity or scientific value; perhaps, for example, by a carefully selected *sheet of advertisements*, which would naturally embrace all articles of mountain equipment, as well as routes of travel and perhaps hotels and boarding houses.

As a guide in planning future numbers I annex a table of the cost of Appalachia *per page*,[1] from which it will be seen that the cost of the letter press has been from $1.69 to $2.22 per page; adding the cost of maps it has been from $1.94 to $2.75 per page; or an average cost of $1.81 for letter press alone, or $2.24 with the maps.

I also annex a connected view of the receipts and expenditures of the last four years, as shown by the Treasurer's books, (the expenditures arranged in the years when they were actually incurred), by which we may compare one year with another.

In conclusion it gives me pleasure to congratulate the Club on the steady growth of their finances. The *net annual receipts*, as shown by the

[1] These statements have been omitted in printing, as being of no interest to the public.

Treasurer's books, during each of the four years of their existence have been as follows, viz.:

1876	$295
1877	410
1878	497
1879	802

If the increase of receipts for the next year should equal that of the last, your Treasurer for 1880 will have to give an account of over $1,100.

Respectfully submitted,

CHAS. WM. FOLSOM, *Treasurer.*

STATEMENT OF RECEIPTS FOR FIRST FOUR YEARS.

Year.	FROM MEMBERSHIPS.				FROM SALES OF APPALACHIA.			From Interest.	From Donations.	From Life Memberships.	Total.
	Admission Fees.	Yearly Assessments.	Back Assessments.	Total. [1]	By Sec. and Treas.	By Publishers.	Total. [1]				
1876	252.00			252.00	24.00	19.00	48.00				295.00
1877	52.00	248.00	12.00	312.00	74.00	24.00	98.00				410.00
1878	76.00	226.00	16.00	318.00	48.00	28.00	76.00		48.00	60.00	497.00
1879	148.00	260.00	40.00	448.00	119.00	11.00	130.00	2.00	222.00		802.00
Tot'l	528.00	784.00	68.00	1330.00	265.00	82.00	347.00	2.00	265.00	60.00	2004.00

[1] The figures in this column are are to be omitted in adding up for the last column.

STATEMENT OF EXPENSES FOR FIRST FOUR YEARS.

Year.	Permanent Fund.	Postage, Stationery, etc.	Miscellaneous Printing.	FOR APPALACHIA.			Topographical Department.	Art Dept.	Improvements.	Total.
				Printing.	Maps.	Total.				
1876		36.00	74.00	(1) 106.00	35.00	141.00			15.00	266.00
1877		39.00	84.00	(2) 115.00	40.00	155.00		18.00		500.00
				(3) 157.00	52.00	209.00				
1878		84.00	161.00	(4) 165.00	35.00	200.00	2.00	58.00	20.00	520.00
1879	60.00	66.00	96.00	18.00		18.00	19.00		159.00	612.00
				(5) 171.00	15.00	186.00				
					(6) 8.00	8.00				
Tot'l	60.00	25.00	415.00	732.00	185.00	917.00	21.00	66.00	194.00	1898.00

Balance now on hand......................................	106.00
	$2004.00

Reports of the Councillors for the Autumn of 1879.

Natural History.

By J. H. Huntington.

The work done in the department of Natural History, during the last summer, shows that many members of the Club are interested in this department.

Botany has occupied the attention of some, and we are glad to present a list of ferns, all of which, except two, were found by Mrs. L. D. Pychowska, in Campton, within a mile of Blair's.

Polypodium vulgare.
Adiantum pedatum.
Pteris aquilina.
Asplenium thelypteroides.
Asplenium Filix-fœmina.
Phegopteris polypodioides.
Phegopteris Dryopteris.
Aspidium Thelypteris.
Aspidium Noveboracense.
Aspidium spinulosum. Var. intermedium.
Aspidium spinulosum. Var. dilatatum (on Mt. Weetamoo).
Aspidium cristatum.
Aspidium marginale.
Aspidium acrostichoides.
Aspidium aculeatum (at the base of Tripyramid, Waterville).
Struthiopteris Germanica.
Onoclea sensibilis.
Woodsia Ilvensis (Breed's Hill).
Dicksonia punctilobula.
Osmunda regalis.
Osmunda Claytoniana.
Osmunda cinnamomea.
Botrychium simplex.
Botrychium lanceolatum.
Botrychium Virginicum.
Botrychium lunarioides.
Botrychium lunarioides. Var. dissectum.

It is desirable to have these lists of plants from as many localities as possible, since from many collections we shall have a complete knowledge of the flora of our mountain region.

Dr. H. A. Cutting called my attention to the fact that the *Rhododendron maximum* had been found in the town of Groton, Vt., and I visited the locality with him. We stopped at Ricker's Station on the Montpelier and Wells River Railroad, and a few rods west, between the railroad and Groton Pond, we found it growing in tangled masses that entirely covered the ground for several square rods. It has an average height of two or three feet, and as the snow here is often five or six feet in depth, it must be buried beneath the snow for two or three months almost every winter. This is the most northern locality known having so great an altitude where this shrub is found.

In Geology Prof. C. E. Hamlin has done important work in his study of Mount Katahdin. He spent eight days on and in the immediate vicinity of the mountain, studying its geology and topography. His paper in regard to the mountain is the most important contribution the Club has yet received.

The following account of a boulder, remarkable for its size and the situation in which it was found, has been furnished by Mr. J. A. McNicol, by whom it was discovered.

"*Quimby's Pillow.* — The following is a brief description of a large and peculiarly shaped boulder, situated on the northwestern ridge of Mount Moriah, in Coös County, N. H. It was named as above, to commemorate the occupation of the U. S. Coast and Geodetic Survey Station by Professor Quimby, by one of whose party it was found. It is about three fourths of a mile from the top and twenty rods westerly from the path constructed by Prof. Quimby to the top of the mountain.

"The boulder is of coarse granite, and stands on a ledge which is of a schistose character. Only a very small portion, perhaps three or four square feet, of the base of the boulder rests on the ledge, and it is about three times as long in the direction crosswise of the side hill as up and down. The boulder is of very regular form, and measures approximately twenty-five feet in height, and is from fifteen to twenty feet on the four sides, containing about 7,500 cubic feet and weighing not far from 600 tons. The under sides slope in towards the centre, making a shelter from the rain, which gives the boulder the appearance of being very unstable, and of being easy to overturn. The ledge on which it rests is not much weathered, and the boulder seemingly rests on as much of it now as at any former period. The side hill is quite steep and covered with spruce and fir trees. A fine view of the Presidential Range can be obtained from the top by trimming some of the surrounding trees. . . . . There is a path cut to the boulder, and at its junction with the path up the mountain there is a signboard to direct tourists."

My own explorations have extended over parts of Maine, New Hampshire, and Vermont. In Bean's Purchase, at a point where the Wild River has cut an immense gorge in the rock, I found a well-marked anticlinal axis. In general the

great area of coarse mica schist that extends from Mount Jefferson nearly to Portland presents only a monoclinal structure, the anticlinal and synclinal folds having, for the most part, been worn away by the great denudation that has removed the original surface.

Several interesting points of contact of the granite and schist were found in Quebec Province, north of the line of Vermont. In the township of Barnston, just north of the boundary, the road crosses several points of granite where it has penetrated the schist, and the line of contact, except where it is concealed by drift, can be followed for a mile or more. The effect on the schist in wrinkles and folds and the concentration of the pyrite is very marked.

Another point where the contact of granite and schist can be traced for a long distance is just east of Memphremagog Lake. This is also in the Province, but the rock here has the appearance of being one of the newer granites.

I made the iron and manganese ores of Rutland County, Vt. a study for several weeks. The iron ores are hematite and limonite; the manganese ores, pyrolusite and psilomelane. With the exception of the specular iron, these ores are associated with limestone and marble, and are sometimes found in depressions between outcrops of these rocks. But the beds are frequently covered by accumulations of drift, which contains boulders eight or ten feet in diameter. The way in which these ores have been accumulated is clearly shown at the Sutherland Falls marble quarry. The marble here forms an anticlinal axis, and along the axis at various depths there are cavities of several feet in extent, which have their longer diameter parallel with the strike of the rock. These cavities are wholly or partially filled with ochre and nodules of iron ore, and at the southern limit of the marble, between it and the limestone, there is a great bed of ochre and iron ore. So it is evident that in the metasomatic development of the limestone, in the process of marble making, the iron was eliminated and lies accumulated in the beds where it is now found.

Reports of the Councillors for the Autumn of 1879.

Topography.—Abridged.

By J. Rayner Edmands.

The most important matter of record for the preceding summer is the occupation of Mount Moriah by the U. S. Coast and Geodetic Survey party, under Prof. E. T. Quimby. Owing to the tardiness of the Congressional appropriation, the announcement came too late for us to plan to co-operate.

The operations of the Deparment were modest, owing to the small appropriation which could be made from the treasury of the Club. The summit of Thorn Mountain (M 5.1) was cleared of timber and occupied with the Troughton and Simms theodolite belonging to Tufts College, and with the help of other Appalachians a light Casella transit, belonging to Harvard College Observatory, was taken to various points in the neighborhood. Thus, a small system of triangles, directly connected with those of the Coast Survey, was established about the Saco valley in Conway, Bartlett, and Jackson. The heliotrope, in the hands of various Club members, was a valuable ally.

The Baldface-Eastman, the Table Mt.-Bear, and the Cushman-Kineo ranges were studied, again with aid from others. A station was established on S. Baldface (H 1.1), an example of perhaps the most desirable way of treating a bare, rocky summit. After drilling the station mark, four rocks are so placed around it that the line of sight between projecting points on the first and third and on the second and fourth rocks shall intersect over the mark. The rocks, however, are at such a distance, that a cairn may be built over the station without disturbing them. In building, two men repeatedly stand, or hold sticks, at opposite sight points, and thus secure that the centre of the cairn shall be over the station mark, within a very few inches. Thus the cairn could be re-erected *in the same place*, should it be overturned.

The hotels and boarding-houses are in the habit, rightly enough, of charging higher rates to transient visitors than to regular guests. Those especially engaged in Appalachian work

are often "transients," but we have generally found the proprietors willing to forego the extra profit in view of the evidently disinterested nature of our errand. We are thus indebted this year to M. C. Wentworth of the Thorn Mountain House, Jackson, to J. A. Barnes at North Conway, and to F. George at Upper Bartlett.

Reports of the Councillors for the Autumn of 1879.

Exploration.

By Charles E. Fay.

The Department of Exploration reports a season of more than usual activity, and is able to announce marked additions to our knowledge of the two regions to which attention was particularly called in the plan of work presented in the spring. (See Appalachia, Vol. II., p. 72.) Nearly all the individual reports rendered to the department, some of which are herewith appended, relate to these two districts.

In addition to the reconnoissance on Mt. Kineo reported below, an ascent to the main summit of that mountain from the Warren side was made by the Councillor of the Department, accompanied by Prof. Pickering. A record bottle was deposited. We descended by the eastern slope to the south branch of Hubbard Brook, and followed the stream down to the Pemigewasset. This trip made certain, what has for some time been surmised, that an approach to Moosilauke from Campton and vicinity, by a path crossing the divide between Mts. Kineo and Cushman, is wholly practicable; not only so, but, taking advantage of existing logging-roads, the work might be done with comparatively little trouble and expense.

The Department would herein especially recognize the efficient zeal of Mr. W. H. Pickering, whose work on the Washington range is embodied in a special article on page 117, and of Mr. Webster Wells and party, whose extensive explorations in the southern half of the Pemigewasset Forest during the past season have so materially added to our knowledge of the detail of this section.

THE BALDFACE-EASTMAN RANGE.—MOUNTAIN POND. BY J. RAYNER EDMANDS.

JULY 31, 1879, Prof. C. E. Fay, Mr. W. H. Pickering, and the writer travelled from Jackson to North Chatham over the range. Aug. 1, the return was made to North Conway in half a day by way of Mountain Pond, Slippery Brook, and the East Branch of Saco. No attempt was made to score a good time record.

Driving about three miles from Jackson to a point (reached at 7 A.M.) near the divide between the East Branch (of Saco) and an east branch of Wildcat Brook, turning from the road to the right, and passing over the *col*, we reached and crossed the East Branch. Then taking the line of steepest ascent we gained the southwest end of the ridge of Mount Sable (H 3.), after which the crest of the range was followed over Sable (3.), Eastman (2.), and S. Baldface (1.1), to N. Baldface (1.2). The first ascent from the road was through a clearing; the southern face of S. Baldface is an almost bare ledge; and the southeastern face of the summit of N. Baldface is comparatively open. The rest of the distance is well wooded. The depression between the two summits of Baldface is not great, but there are steep ledges in ascending to the northern. We found with difficulty some water just before ascending Eastman. There is good water also just before ascending S. Baldface, and there is a spring, possibly "occasional," between the two summits of Baldface.

On the summit of S. Baldface we drilled a station mark, over which we erected a cairn.

From N. Baldface we followed the crest of the range in the direction of Mount Royce. There are here summits and *cols*, with lateral ridges separated by ravines, instead of the simple conformation indicated by the contours of the State map. For the mountain mass nearest to Royce we heard in Chatham the name Meader. The crest northward from Baldface is quite "scrubby," and the journey soon became a forced march. Our route, being a compromise between a desire to follow the crest and to reach shelter, is not worthy of detailed description. At half-past eight in the evening we struck a logging-road in one of the easterly ravines of the mountain lying between Baldface and Meader. Here a stop was made, after which we followed the logging-road at a leisurely pace by moonlight. We spent the night at Asa Chandler's, above N. Chatham, on the road which runs up the Cold River valley from Fryeburg.

Next day we started late in the forenoon, rode about three miles, to the head of a road which follows the Little Cold River, and entered the woods about noon. A good logging-road extends as far as Mountain Pond. We reached the pond in an hour and a half, stopped there for an hour and a half, and then followed the stream. It is boggy near the outlet of the pond. Some aid is afforded by the logging-roads, but a reliable trail is very desirable. Finally we struck a logging-road, which brought us to the Dundee road.

A continuous path from the Dundee road to Mountain Pond would

furnish a delightful and easy excursion from North Conway, Jackson, and Bartlett, besides adding the mountains near the head of Cold River to those which can be explored from head-quarters in the Saco valley.

The accompanying times and elevations according to aneroid barometer are from Mr. Pickering's observations:—

	Time Interval. h.	m.	Elevation. ft.		Time Interval. h.	m.	Elevation. ft.
Left the Road	0	0	1200	Eastman	6	50	3470
S. W. end of Sable	3	30	2800	S. Baldface (arr.)	8	50	3600
Sable	4	20	3140	" (left)	9	25	
Col	4	55	2760	N. Baldface	9	45	3600

A Three-days' Trip over the Hancock–Carrigain Range. By Webster Wells.

On Wednesday, Aug. 27, 1879, two members of the Appalachian Club, accompanied by two experienced woodsmen to act as porters, left Greeley's, Waterville, equipped with rations for four days, and bent on exploring the hidden recesses of the great central range of the Pemigewasset forest. We passed rapidly over the five miles of well-constructed path leading to the Greeley Ponds, and then plunged into the trackless wilderness which is watered by the Hancock Branch and its tributaries. We skirted the westerly slopes of Mt. Huntington, and finally, at about one o'clock, struck the Hancock Branch about half a mile east of its great south bend. After a hearty dinner at this point, we journeyed up the bed of the stream; preferring the rough rocks of the channel to the intricate snarl of underbrush and fallen timber which encumbered the mountain slopes on either side.

About two miles from our noon resting-place, we came to a place where the stream divides; one branch coming directly down the side of Hancock, the other flowing out of the notch between Hancock and Huntington. From this point, we followed the left-hand branch, and in a few minutes we came upon a beautiful cascade; the water pouring in sheets over a rock formation which resembled a gigantic staircase. By six o'clock, we had followed the brook so far that a few pools were all that remained of it, and we decided to camp for the night. We were apparently at the base of the first of those mountains which we intended to explore, — Mt. Hancock; all around us towered the vast peaks and spurs of the mountain; and amid these grand surroundings, with a camp-fire in front of our rudely constructed cabin which burned several cords of wood in the course of the night, we slept soundly, storing up strength for the arduous labors of the morrow.

The next day, we rose at sun-rise, ate our breakfast, and got the dishes washed in time to start at seven o'clock for the ascent of the mountain. We climbed directly up the slope, and in an hour reached the crest of the

ridge which joins the two principal peaks, where we got a fine view of Carrigain towering two or three miles away, and presenting a remarkably massive appearance. We then followed the ridge line to the summit, which we reached at 8:30 A. M. The peak is covered with black and second-growth in about equal proportions, the line of demarcation traversing the very highest point in a direction from northwest to southeast; the second-growth being on the southwest side of this line. From all points of the low second-growth there is a good outlook, and a prospect embracing the whole mountain district may be obtained by climbing a tree. The view is grand, but does not equal that from Carrigain in comprehensiveness; the view of the latter peak, however, from Hancock, is very fine. We were unable to obtain a satisfactory view of the great East Branch valley, owing to the huge spurs which the mountain thrusts out to the north.

After two hours on the summit, we started down the mountain on the east side, intending to make a bee-line for Carrigain. We crossed a deep ravine and climbed to the summit of a tremendously steep and craggy ridge which lies between the two mountains. From its east side we got fine views of Carrigain, only a mile away, and on its slope, a quarter-way up, we noticed a little pond, hidden away in a deep recess, and surrounded by unbroken forests. We decided to make for it and dine on its shores. We reached it without difficulty, and found it to be about twelve acres in extent; its sandy beaches were completely covered with deer tracks, some of which our men said had been made within an hour. No traces of axe-marks or fires could be found in the vicinity, and it is doubtful if any human beings have ever before visited the locality.

After an hour and a half in this charming spot, we easily climbed to the summit of Carrigain in an hour, and, after a short stay, descended by the Club path and camped for the night at the point where the logging road to Livermore Mills crosses Carrigain Brook.

Our programme for the next day included a visit to Carrigain Notch, and the ascents of Mts. Anderson and Lowell. By great good luck, though none of us had ever been there before, we managed to pick out of the intricate maze of logging roads the proper route for the Notch, and after a tramp of an hour and a half we reached the divide. A few minutes' walk around the northerly slope of Lowell, on a level with the height of land in the Notch, brought us to a brook, crossing which we stood on the flanks of Mt. Anderson, and an easy climb of three quarters of an hour placed us on the peak. This mountain is wooded nearly over the whole summit, but a projecting ledge on the southwest side affords a grand view, comprising all the peaks of the mountain district from the Northern Kearsarge around by the south and west to Mt. Hale. The view of Carrigain is good, though not to be compared with that from Lowell; but the East Branch valley is shown far more satisfactorily than from the latter peak, and forms the most charming element in the prospect.

After an hour on Anderson, we struck through the woods to Mt. Lowell, which we reached in half an hour of easy walking Lowell, like

Anderson, is wooded on the highest point, but a horseshoe-shaped clearing extends around the north side of the peak, by moving around which a view of nearly the whole horizon may be obtained, the only peaks invisible being those between Chocorua and Passaconaway. From a projecting ledge on the northwest side the best prospect is to be had, and the view of Carrigain from this point, looming over the profound depths of the Carrigain Notch, is one of the grandest sights among the mountains. The view of other mountains, too, is quite satisfactory, all the principal peaks of the White Mountain district being visible. We spent two hours on the ledge, and then descended the precipitous west side of the mountain into the Notch; a most arduous trip, and one which, owing to its dangerous character, I would not advise any one to undertake. Three quarters of an hour from the peak we crossed Carrigain Brook, soon found our friendly logging road, and half an hour later reached our camp of the previous night.

We packed up our things, started towards Livermore Mills, and when within half a mile of them crossed Sawyer's River, and headed for Waterville by way of the new path. Thunder had been muttering in the northwest for some time; and just as we reached the Waterville path, a heavy storm broke upon us. We pushed on through the rain and mud, and in about half an hour reached a dry shelter in the shape of a deserted log cabin. As this contained an iron stove and plenty of dry fuel, we were soon drying our wet clothes before a roaring fire; and after a good supper of trout and fried potatoes, we passed a quiet night.

Saturday, we returned to Waterville by way of the new path, where we arrived in good condition at 10 A. M., thoroughly satisfied with our trip, and resolved that it should not be our last expedition into this great stronghold of Nature.

EXPLORATION NEAR WEST CAMPTON, N. H. BY MISS MARIAN PYCHOWSKA.

To the long range of mountains beginning at West Rumney, and bending round through the towns of Wentworth, Warren, and Ellsworth, toward the Pemigewasset at West Thornton, is given the general name of Carr's Mountain by the old Grafton County map. Walling's map, issued for the Club in 1877, restricts this appellation to the high ridge which runs approximately north and south, the peak in the corner being now called "Mt. Kineo." There still remains unnamed the extreme eastern end of the range, overlooking the Pemigewasset Valley, and divided from Kineo by a marked ravine. This mountain is seen from the roads about Campton Village and West Campton, as a dark, wooded mass, unattractive to tourists. Prof. Fay suggested it as an object of exploration to Mr. E. B. Cook (A. M. C.), of Hoboken, N. J., and his party.

The commission was executed, though rather hastily, Sept. 22, 1879, Mr. Cook being accompanied by Mr. George A. Sargent of Boston, and

two ladies of his own family. Our landlord, Mr. J. C. Blair, drove us, by the Ellsworth road, to the Dustin Farm on the slope of Peaked Hill. Inquiring of Mr. Dustin the name of the mountain of our hope, he could only tell us that "the New Hampshire Gazetteer calls it Carr's Mountain." The walk was begun at 11:15 A. M., and our first aim was "Uncle Ham's Hill," which, with Peaked Hill, forms an outlier to the main ridge. The top of this spur is northwest of Dustin's, in distance about a mile, and the way is pleasantly varied by pastures, a wood-road, and open ledges. From Uncle Ham's Hill we went due north toward the pine-clad ridge, of which we caught glimpses between the trees. Descending into a ravine filled with a fine undergrowth of hobble-bush, and crossing two small streams running eastward, near which marks of lumbermen were found, we began to turn the end of the mountain. Here we changed our direction a few points to the west, and soon attained the easternmost crest at 1:25 P. M. The distance from Dustin's is about two and a half miles. A little to the west was another crest, which seemed to be the highest in the neighborhood. So far, no view had been obtained, spruces of a considerable height covering the ridge. A little after two o'clock, we continued our way to the north of west, over a depression and up a crest considerably higher than the former one. From here the ridge is varied by masses of broken rock, thick set with good-sized spruces and covered deep with moss. Water was abundant in mossy swamps in every depression. The crest of the mountain is about three quarters of a mile long in this direction. Having reached its western slope, an opening in the trees gave a glimpse of Mt. Kineo across the dividing ravine, which seemed to be quite deep. Two of the party remained here while Mr. Cook and the writer pursued the investigation along the ridge running north. This extends perhaps half a mile, and was scoured in search of some view point toward the Franconia Mountains. By dint of climbing a small tree, we saw, through an opening, Moosilauke, with its great gorge, looking very near and grand across the valleys in which Baker's River rises. The high farms in Warren seemed six or seven miles away. Encouraged by this outlook, we sought one toward the northeast. On this slope, we found an opening made by a large spruce, which had fallen into the arms of its neighbors below, forming a comfortable bridge from which the following view was obtained: Kinsman, Cannon, the Notch, Lafayette, Liberty, Flume, and the Twin-Mountain Range rising grandly beyond the lesser mountains of the East Branch. Over Loon Pond Mountain tower Washington and his fellows (these were capped with cloud when we saw them). To the right are Hancock and Carrigain, Osceola, and Tecumseh, with Tripyramid over its flank. — The writer thinks this view remarkably fine, the Franconias being so near, and the White Mountains coming in so well between the high ranges of the Twins and Hancock. It is much to be regretted that time and our artist were both behind us, so that we obtained no profile.

Having returned to the rest of the party, as it was about half-past three o'clock, we started home along the south slope of the mountain,

our direction southeast. Excellent water was found in several small streams. A number of logging-road heads were crossed, with the accompanying confusion of felled trees, and everywhere hobble-bush had established its sway. About two miles brought us back to Uncle Ham's Hill, which we descended quickly to the Dustin Farm, reaching it at 5:15 P. M.

We had found no bare ledges on the mountain, and the summit seems to offer no spot where a small clearing would open a circular view, as the slopes are gradual and the trees high. From none of the points from which we have observed the mountain does the ravine between it and Kineo get its true value. The ridges must so lie as to screen it from the south.

AN ASCENT OF MT. KINSMAN. BY GAETANO LANZA.

ANY one who has been at Sugar Hill, N. H., must have noticed the long serrated ridge extending apparently from Profile Mountain to the west, and terminating in a rather pointed summit. This latter is the second summit of Mt. Kinsman; the real summit of which, though visible, appears lower than this one.

The country people in the neighborhood call the several mound-like summits of the above-mentioned ridge the Haystacks, a name long associated with the summits of the Lafayette range; while to Mt. Kinsman they give the name Mt. Pemigewasset, which is commonly applied to a spur of Mt. Kinsman overlooking the Flume House. The mountain next east of Mt. Lafayette, commonly known as the Haystack, they call Hooket Mountain.

The view from the neighboring peaks reveals a nest of summits on the west of the Pemigewasset River and the Notch, and between the latter and Mt. Moosilauke; all of which the maps include under the name of Mt. Kinsman. It was with a view to investigate this region that this ascent was made. Leaving Goodnow's at Sugar Hill at 6:45 A. M., Aug. 22, 1877, the writer, in company with Mr. Ellis Seymour of Brooklyn, N. Y., drove about six miles on the Landaff road, keeping always to the left, and hence nearest the mountain, to Bolles's farm. It is true that the greater part of the farmers on the Landaff road are named Bolles, but by proceeding as above indicated for about six miles the right farm will be reached. There we left our horse and buggy at 8:15 A. M., and proceeded on foot, first for a short distance through the woods, by a path indicated by the Bolles family, to meet a brook which flows down the ravine between the ridges that proceed from the above-mentioned summits. This brook flows almost exactly west, its course being nearly straight, and it is remarkable for its beauty; its bed being composed of immense ledges of granite, and containing a great number of picturesque cascades and basins, thus furnishing very easy travelling and a number of interesting studies for the artist, and rendering a trip to the brook an easy and pleasant one, even for those who are not disposed to press on to

the top of the mountain. The view from points along the brook is not extensive, being cut off by the ridges on each side; but from almost all points the valley beneath and the hills in the distance are visible.

After following this brook for about a mile and three quarters from the road, to a point where it loses itself in the woods and scrub, we found ourselves at the foot of a short, but well-marked slide, coming from the right-hand ridge. There is a similar slide on the left-hand side also.

It was of special interest to me to compare this slide with two others, which I visited last summer. In this case, it appears as if the earth and vegetation had slid down from the top, leaving bare a single convex rock, sloping at nearly 35° to the horizon; the rock, of course, is more or less in the form of ledges, but there are no signs of a gully or water-course in it. On the other hand, the slide on Scar Ridge, though as rocky as this one, contains a brook flowing almost from the top of the mountain, and a very distinct gully; and at one place is found a feature very similar to that part of the slide on Tripyramid known as the V. The third is the Tripyramid slide, of which, as we all know, the upper part is composed of loose gravel. This slide on Kinsman cannot be more than a quarter of a mile long, as it required only twenty-six minutes to ascend it, and it is quite steep, it being necessary in some places to cling to the bushes on the side.

The road thus far was easy and pleasant, but after reaching the top of the slide we had to make our way through perhaps half or three quarters of a mile of as bad scrub, rotten and fallen timber, and moss-covered rocks as one often meets with. We reached the summit at 11:05 A. M.; it is cleared, and has been marked by a Coast Survey signal. The view is, of course, not very extensive, as the proximity of the Lafayette range causes a large part of the horizon to be cut off; but a fine view is afforded of distant mountains on the north and west, and also of all that unexplored wilderness back of the Profile House, with its various summits. Moosilauke is, and appears to be, quite near.

The height, for want of a barometer, could not be measured, and, not being well acquainted with the names and features of all the mountains, I cannot state with certainty all that can be seen, but I marked the following as features of the view: — Profile; Lafayette, and its range of Lincoln, Liberty, and Flume; Carrigain; Tripyramid; Moosilauke; a number of the Green Mountains; the Stratford Peaks; and a round mountain, which may be Owl's Head in Canada; besides many other northern mountains.

We remained on the summit until 12:35 P. M., and reached Bolles's at 3:30 P. M., stopping on the way half or three quarters of an hour for my companion to sketch one of the cascades. We arrived at Goodnow's at 4:40 P. M., having had a very pleasant trip.

So far as I can ascertain, this mountain and this region have been but little visited, and it is with a view to call attention to the fine opportunities here afforded to those interested in topography, in exploration, or in art, that I make this communication. In commencing an exploration

of this region, it seems to me that an ascent of Kinsman might first be made, and from there profiles could be taken and the subsequent trips planned. If an excessive time were not consumed in this work, and the explorers were good pedestrians, it might be possible to visit the second summit on the same day. I should say that this could easily be done, were I sure that one would not encounter a large amount of scrub.

Reports of the Councillors for the Autumn of 1879.

Improvements.

By W. B. Parker.

The plan of work laid out in the report of last spring for our summer's campaign seemed no more than we could reasonably expect to accomplish; but it is one thing to lay plans and quite another thing to execute them. The Department of Improvements, however, has not been idle during the summer vacation. It has something to report, even if the eight paths proposed in the spring have not all been built. There have been some energetic members of the Club doing enough good work in other directions to more than counter-balance the unfinished, or untouched, work proposed.

In the report at the field meeting, held at North Conway last August, mention was made of a new path up Mt. Tecumseh, built by the guests at Greeley's. Perhaps it ought properly to be claimed by the Club, since it was principally done by volunteer members and those interested in it. A description of this and other paths about Waterville is given by Mr. Wells below.

Mr. Samuel H. Scudder, Dr. Geo. L. Goodale, and Mr. G. W. Hammond spent a week on Mt. Adams in August last, and did some good work there. The path was carefully remeasured, and at short intervals new distance-marks were placed, besides other valuable improvements, the particulars of which are given by Mr. Scudder below.

At the instigation of some members of the Club, a good path has been made to the summit of Carter Dome by Mr. Jonathan G. Davis of Jackson. This path begins between the ponds in Carter Notch, and a good climber can reach the summit in one and a half to two hours, instead of three or four as formerly.

On Thorn Mountain, Mr. J. Rayner Edmands had the summit cleared, and in the field near the entrance of the path a sign placed so conspicuously that it could be seen at a considerable distance.

A guide-board has also been placed at the entrance of the Mt. Willey path, plainly visible from the railroad.

Of the eight paths in the plan for the summer's work, the first to be reported on are the Livermore-Waterville and Mt. Carrigain paths. These are separate paths, but built under one contract. The work was done last June, and inspected by the Club on the 10th and 11th of July.

The path on the mountain was to be a foot-path, which on inspection did not prove to be quite up to the standard of an Appalachian path. It has, however, been put in satisfactory order since.

The path to Waterville is a bridle path, beginning about two miles from Livermore on a logging road leading from the mills at that place, and runs in a southwesterly course along the northwest base of Green's Cliff, crossing Swift River, near a beautiful waterfall, thence through the notch south of Mt. Kancamagus to Greeley's. The path is abundantly supplied with delicious springs and mountain streams. There is also a good spring about half-way on the Mt. Carrigain Path.

At present the distances are only estimated. From the mills to the summit of Carrigain is about six miles. From the mills to Waterville, ten to twelve miles.

Three boards, about forty-eight inches by twelve, were made with the words "American Institute of Instruction Path" upon each; under which name these paths are to be known. One of them was nailed upon a tree, on the logging road, at the entrance of the path to the summit of Mt. Carrigain, by the excursionists who ascended the mountain on the 10th of July. Another, the following day, on the logging road where the Waterville path begins. The third was intended for the end near Greeley's, but no one being found who had the courage to undertake the task of transporting it upon his shoulder for a distance of ten miles or more, it was left in the store at Livermore, where it is feared it still remains.

The paths, although the cutting is done, can hardly be con-

sidered completed until guide-boards are erected, and they are measured and marked. Some thirty or forty guide-boards are necessary to be put up on the numerous logging roads that would bewilder the stranger. These boards, including distance-marks for each kilometer, are nearly all made. The erection of them and the measuring will, it is hoped, be among the first work to be done the next season.

There was nothing done, I believe, upon the second path proposed, namely, the one from Greeley's to the foot of Mt. Whiteface.

The proposed path from Woodstock to the foot of Moosilauk having been taken up by other parties and completed as a bridle path, the Club was relieved from all labor in that direction.

The fourth was a path to be reopened on Mt. Chocorua. We did not succeed in accomplishing this. But in August Messrs. Wm. L. and Chas. P. Worcester, Miss Margaret Worcester, and Rev. T. F. Wright measured it, and marked each kilometer, and put up a few guide-boards.

The Messrs. Worcester and Mr. Wright, after having done a little necessary work on their path on Moat Mountain, took up the work they began the season before, namely, that of making a path from the north to the south peak of the mountain. After several days' hard labor, they succeeded in clearing a good path through the "jackstraws" that previously stared one in the face, ready to tear his clothes to shreds, or, if made of unusually tough material, to suspend him in the air. Now we can walk peacefully along from one peak to the other, and enjoy the views as we go. Any one who has ever had any experience with these wicked snags will not fail to appreciate the amount of labor in cutting through them. Those who have never been upon the south peak of Moat have yet in store one of the most beautiful views that North Conway affords, — to my eye, far superior to that from the north peak. The path on the east side of the south peak, unfortunately, is not yet completed as intended.

The path over Mt. Bartlett to Mt. Kearsarge, starting near the Pequawket House and joining one from near Tasker's, was bushed out by the Messrs. Worcester and Mr. Wright.

The last path to be reported is perhaps the most interesting to us. It is one that will long be remembered by many who made a visit to Tuckerman's Ravine last August. It starts from the Crystal Cascade, follows up the left bank of the brook for about a mile, then crosses it and goes up the other side till it connects, near Hermit Lake, with another path coming in from the Mt. Washington carriage road and going on to the Snow Arch. This latter path was built the past season at the expense of Mr. Milliken, of the Glen House, and Mr. C. B. Raymond, of Boston.

It was intended to carry the Club path through the Ravine to the summit of Mt. Washington, but Messrs. Milliken and Raymond having preceded us to the Snow Arch, we hoped they might decide to carry farther the good work they had begun. Funds, too, were wanting; so that portion of the undertaking still remains to be carried out. The path was carefully measured by Messrs. Worcester and Wright from the Glen Road to the Snow Arch.

Signs for each kilometer were put upon our portion of the path, a large guide-board at the entrance on the Glen Road, with the distances upon it; also other necessary guide-boards along the path.

They found the distances to the Cascade three eighths of a mile, to Hermit Lake two miles, and to the Snow Arch two miles and three quarters. Our path was cut by Mr. Davis, of Jackson, and his father, and required six days, including one day's hard labor in building a camp. This camp is near Hermit Lake, a little back in the woods, and about forty or fifty meters from the brook. It is twelve feet long inside, and can accommodate about eight or ten persons. It is *completely furnished* with a sharp axe and a box of matches!

The new record boxes, made to replace the old bottles, have been placed upon several mountains, viz.: —

On Mts. Osceola, Tecumseh, Black, and Tripyramid, by Mr. Webster Wells; also by the same gentleman on Hancock, Anderson, and Lowell.

On Mt. Carrigain by Prof. Wm. H. Niles and party, July 10, 1879.

On Mt. Willey, the same day, by Mr. J. Rayner Edmands.

On Mt. Adams, August 20., Mt. Jefferson, August 21, and the A. M. C. Camp (Mt. Adams), August 22, by Messrs. Scudder, Goodale, and Hammond.

On Moat Mountain the record was found somewhat damaged through the breaking of the bottle. It was carefully copied by Lieut. H. C. Tallman of New York, and redeposited in one of the new boxes.

PATHS TO BLACK MOUNTAIN AND MT. TECUMSEH. BY WEBSTER WELLS.

THE new path to Black Mountain leaves the road just west of the crossing of Drake's Brook, two miles from Greeley's, passes over the subordinate summits of Noon and Jennings Peaks, and ascends the ridge connecting the latter with the main summit. On leaving the road we ascend gradually through an open forest, the grade being very easy and the walking good. On our way up, we cross several bare ledges, which afford beautiful retrospective views over the Waterville valley and its surrounding mountains, with the peak of Washington prominent in the distance. At a point 1¼ miles (1.95 kilometers) from the road we attain the crest of the ridge connecting Jennings and Noon Peaks, and at this point a branch path, 325 ft. (100 m.) in length, leads out to the summit of the latter. The view here is very fine; at our feet lies the valley, completely invested on the north by the great peaks of Tecumseh, Osceola, Kancamagus, and Tripyramid, beyond which tower Hancock, Carrigain, and the principal White Mountain summits. On the east, we look down a sheer precipice, a thousand feet in height, to the ravine of Drake's Brook, beyond which lies the vast forest-covered mass of Flat Mountain, with Whiteface just visible over its highest point. The view to the south and west is closed by the immense spurs of Black Mountain.

Returning to the main path, the next mile carries us over the nearly level ridge connecting Jennings and Noon Peaks, forming the pleasantest portion of the trip. The path is laid out on the very edge of the ravine of Drake's Brook, and many fine outlooks are afforded where it crosses broad ledges. About half-way between the peaks is a cold spring, some twenty feet off the path; this is the only water which has been discovered in the vicinity of the path, though we have heard rumors to the effect that a spring was located between Jennings Peak and the main summit. At a distance of 2¼ miles (3.55 kilometers) from the road, the path bends suddenly to the south around the slope of Jennings Peak, and a branch path 350 ft. (105 m.) in length leads up to the summit. The view from this peak is one of the finest in the vicinity of Waterville, being scarcely inferior to that from Black Mountain itself. The summit is ledgy, and the few trees are too low to obstruct the view. The prospect is very extensive, especially towards the south and west; nearly all the

prominent peaks of the mountain district are visible, and the distant view includes Monadnock, Ascutney, and the Green Mountains of Vermont.

From Jennings Peak the path descends slightly to a sort of saddle, and then ascends the gradual northerly slope of the main summit of Black Mountain, which is reached without difficulty, this part of the route lying in a remarkably beautiful forest. The total distance from the road to the final peak is 3¼ miles (5.26 kilometers), and it has been accomplished by ladies with perfect ease in three hours. Taking into consideration the fine view-points scattered along the path, especially the extensive prospects from Noon and Jennings Peaks, I think we may regard it as by far the most interesting excursion in the neighborhood of Waterville, and one of the most delightful in the whole mountain region.

The path to the summit of Tecumseh branches out from the Osceola path at the crossing of the West Branch, ⅞ mile (1.4 kilometers) from Greeley's, and makes a nearly straight line to the summit; the grade, at first, is very easy, but near the peak the path is quite steep. About 1⅜ miles (2.2 kilometers) from the house a branch path, an eighth of a mile in length, leads out to a pretty cascade, situated on the brook which empties into the West Branch near the junction of the paths. 2¼ miles (3.6 kilometers) from Greeley's we come to a spring of delicious water, and at a point an eighth of a mile below the summit we get the only outlook on the path, commanding a view of the Franconia, Twin, and White Mountain ranges, and the mountains of Bartlett and Conway. The total distance from the house to the summit is 3 miles (4.9 kilometers); it forms the easiest mountain excursion from Waterville, and the round trip has been made in a half-day by ladies.

Work on Lowe's Path on Mount Adams in August, 1879. By Samuel H. Scudder.

Our party remeasured the path with a telegraph-wire ten meters long. Just before using, the wire was marked with a steel tape, and again, as soon as the work was completed, with no apparent change. The route selected at the base was by a new entrance cut by Mr. Lowe, leaving the road in front of his house, and passing by an easier and slightly longer ascent than the former path, joining it at Grace's Camp between six and seven hundred meters from the road. Probably nearly 200 meters are thereby added to the distance, but the route appears to be preferable; the bog at the entrance is not so bad, and Mr. Lowe promises to make it passable dry-shod in the worst season.

The King's Ravine path branches off at $2^k.42$. The camp is at $3^k.26$; and the first outlook above the trees, at about $4^k.25$. Just before reaching 5^k, and while evidently following exactly the trail of the former measurements, Mr. Nowell's $4^k.5$ is found; so that, allowing for the addition to the length of the path at the base, there is a discrepancy between the two sets of measurements up to this point of about 300 meters. The entire

distance measured to the summit of Adams is $6^{k}.7$, which gives a further discrepancy (in the same direction) of about 200 meters. This, however, is probably due to an unfortunate mistake of ours. Laboring under the impression, from recollections of Mr. Nowell's plan of the path, that his trail clung to the crest of the ridge even to the summit of Sam Adams, we took our course on reaching the base of the latter to its northeastern shoulder, instead of flanking the northeasterly base of the same; when this was reached, it seemed so preposterous to carry the line over the summit itself, that we bent our course on the shoulder to gain more directly the base of the cone of Adams. Our $5^{k}.6$ is near the summit of the point called Nowell's Peak in APPALACHIA, Vol. I., pl. 8; and I would suggest that a new measurement be made from this point by the more direct original trail.

Kilometer signs, twenty-four by thirty-six centimeters in size, prepared for the wooded portion of the path, were forwarded this spring to Mr. Lowe to put up. They mark the distance from the base and the height above the sea, thus:—

$4^{k}.0$
1247^{m}
above the sea.
A.M.C.

1^{k} is 553^{m} above the sea; 2^{k}, 718^{m}; 3^{k}, 917^{m}; 4^{k}, $1,247^{m}$. The camp, at $3^{k}.26$, is therefore on the steepest part of the path. These heights are obtained from previous measurements, and from observations we took, repeatedly, at every half-kilometer with the holosteric barometer.

Signs of the same size are also prepared for placing at the entrance of the King's Ravine path, and at the camp, the latter registering the height, $1,006^{m}$. One, bearing the single word PATH in bold letters, has also been sent to Mr. Lowe, to be placed at the entrance of the path into the forest, where it can be seen from the stage road.

Hectometer signs were painted on the spot, and put up at the end of every hundred meters (excepting, of course, where a kilometer sign is required) from the base to $3^{k}.5$. These signs are eight by sixteen centimeters in size, white, with the symbol $1^{k}.6$, or whatever the distance from the base may be, painted black in the largest possible characters. They are each fastened by two galvanized iron nails, face to the path, to spruces or birches, at a height so great that no temptation is offered to scribblers. The path proving longer than was expected, five more similar signs, carrying them to $4^{k}.1$, have since been prepared and forwarded to Mr. Lowe, who has promised to put them up.

Above timber, the same marks have been made at every hectometer (including the kilometers) to the summit, by white paint upon the rocks, usually accompanied by an arrow pointing to the next hectometer mark below. These points are further marked in most places by a small pyramid of stones, but the weather prevented the completion of the task. At the summit of Adams, the magnetic-meridian arrow cut by Mr. Nowell

was filled in with white paint to render it more conspicuous; and two arrows, a meter or more long, were painted on the rocks, one pointing toward Jefferson, the other in the general direction of Lowe's path, and correspondingly marked.

All these paint marks on the rocks will wear out, and will no doubt have to be renewed at least every three years; it seemed preferable to paint them upon horizontal, rather than vertical faces, as previously done, because they are then visible from every direction, and much more readily found. Coming down Adams in a dense cloud, Mr. Hammond and myself struck the path we had marked the day before at $5^k.7$, (before that we had taken the shorter cut of Nowell's trail,) and, while making rapid progress, did not miss a single hectometer mark so long as the cloud lasted, — a distance of twelve to fifteen hectometers.

The new metallic Appalachian record-bottles were placed on Mt. Adams, August 20, Mt. Jefferson, August 21, and at the camp, August 22. A few matches were added in that on Mt. Adams and the one in the camp.

It may be worth mentioning that the A. M. C. Camp, hitherto a perfect protection from the weather, proved liable to danger from an unexpected quarter. Before daylight in the morning of August 19, after a night of unprecedented rain, we found a stream of water issuing from beneath the camp, and the camp itself flooded; two streams had broken out of the mountain-side about half-way down the clearing, and joined at the camp, the upper wall of which was serving as an imperfect dam for a large and increasing pool of water. After half an hour's work, we turned the streams, but the whole of the succeeding day had to be employed in drying our bedding, and it was twenty-four hours before the water ceased to drain from beneath the camp. The storm of that night has been compared to the one that caused the Willey Slide (at the same season of the year), and it dislodged a huge rock lying near the gate of King's Ravine; this came plunging down the approach to the gate, ploughing the ground and scattering desolation along its path. Such a storm is not likely to visit the camp again for many a day; but it would be well for those who may chance to pass another such night there to remember the possibility of discomfort, if not of disaster.

Reports of the Councillors for the Spring of 1880.

Natural History.

By J. H. Huntington.

In presenting a plan for the summer's work, the Councillor of Natural History would call attention to the suggestions which he made last year, and he would like to have the mem-

bers of the Club read the valuable suggestions made by former Councillors of Natural History which have been published in APPALACHIA.

It is very desirable that some one interested in Entomology should obtain the eggs of the White Mountain butterflies. Instruction as to securing these, and the reason for so doing, will be found in APPALACHIA, Vol. II. No. 1, p. 65.

If those interested in botany will obtain the tables prepared by B. Pickman Mann, of Cambridge, Mass., and published by the Club at considerable expense, we shall soon have a much more systematic knowledge of the botany of the mountains. The tables can be obtained of the Secretary, and the catalogue to which the numbers in the tables refer will be furnished by Mr. Mann for thirty cents per copy.

Collections of all the plants found within a given area will be of special value, as catalogues of these could be published from year to year, and additions and corrections can be made by persons making the collection, or others, until we have a complete knowledge of the flora of the region.

In geology systematic work might be done, if some limited area were selected, in the vicinity of which a large number of the Club were spending several weeks. One of the most interesting areas where this is likely to be the case is Kearsarge (North). If topography were combined with geology, a model of the mountain could be made, and we should have something that would show the work of the Club to the very best advantage. The mountain has already been studied enough to show that the geology is most interesting, but a special study to trace accurately each of the different groups of rocks, and collect specimens, particularly along the lines of contact, would undoubtedly bring to light many features of structure and points in lithology that would interest nearly every member of the Club.

I should like again to urge all who can to collect specimens of rocks, especially from unfrequented localities, to present to the Institute of Technology. The specimens should be about 100 mm. by 75 mm., and as thin as it is convenient to get them. The outlines should be regular, and the sides should show fresh fractures, and in all cases the locality where they are obtained should be definitely stated.

The Councillor of Natural History will be glad to give information in regard to any region where he is familiar with the country, or to point out where information can be obtained if the locality is unknown to him.

Reports of the Councillors for the Spring of 1880.

Topography.

By W. H. Niles.

The attention of members interested in the topographical work of the Club is called to the importance of a comprehensive geographical study of the "White Mountain Area," with the hope of more definitely determining and characterizing the natural divisions of the mountains. It is as desirable to know the composition, topographical characteristics, and name of a range of mountains, as to be acquainted with its members. Each mountain derives much of its importance from its association with others or its isolation from them, and the true classification of the mountains of a district is as dependent upon their natural groupings as upon their physical features. Could all the ranges be well defined and acceptably named, we could then distinguish different mountains, which now have the same name, as the several "Black" mountains, for example, by the ranges to which they respectively belong. In this way, many ambiguities, difficulties, and objections to change of name may be avoided. It is hoped that the department may some year be able to present a systematic analysis of the whole "Area" into all its natural divisions, to indicate the characteristics of each, and to more perfectly unfold the system to be seen in the structure and composition of the group.

The question now before us is, How may we direct this season's observations that they may subserve this purpose? There are many eminences which we are not now able to pronounce distinct summits in a range, or to declare only shoulders, spurs, or secondary summits of one mountain. There are a number of the smaller axes of elevation, of which we do not yet know whether they are by nature branches merely, or distinct ranges

in themselves, and there are several small groups of hills or mountains whose geographical affinities or distinctness are not determined. Careful observations upon the depth, breadth, and general character of the separating valleys and gaps, also upon the nature and trends of the connecting *cols* or ridges of any range, will be of value to the department. Observations upon the differences or resemblances of adjacent ranges or parts of the same range are important, and when the geological structures of the ranges are determined the comparisons will be rendered especially valuable. Those interested in this work are advised to use the White Mountain section of the State map of New Hampshire published by H. F. Walling (see APPALACHIA, Vol. I. No. 3, p. 184) in connection with their observations, and to keep a careful record of verifications and discrepancies observed in the less known districts. Whenever these observations can be accompanied by measurements and geodetic determinations, they will most contribute to our knowledge of the mountains.

This department of the Club is very fortunate in still having the geodetic part of the work under the direction of Mr. J. R. Edmands, who, at the Councillor's request, kindly presents the following portions of this report.

Especial attention will be paid this summer to co-operating with the U. S. Coast and Geodetic Survey during its occupation of Mount Washington. A tower is being built for the protection of the tripod holding the instrument, and for the support of the observer, of sufficient height to overlook the buildings on the summit. From this tower they will observe heliotrope signals, when seen from Appalachian stations, in connection with those of their own triangulation, *except* between the hours of 11 A. M. and 2 P. M. During that mid-day interval the theodolite will be displaced to make room for the vertical circle, unless, in case of necessity, it be especially arranged otherwise for a given day. In order that a signal shall not be overlooked, Prof. E. T. Quimby should be notified by mail to expect it. A report of any signalling done should also be sent him promptly. The method of marking the

station and sending the signal is simple, and is explained in a circular which will be sent on application. Observation will begin late in July.

The observation of certain points should not be left to chance. Any member, therefore, who is inclined to undertake any signalling is requested to address J. R. Edmands, at Harvard College Observatory, Cambridge, Mass., in order that as many points as possible may be definitely provided for. For some of this work heliotropes will be loaned. More precise information will be sent, later, to those who apply for it.

It is anticipated that co-operation in this and in various other ways with the Mt. Washington observers will interfere with much of the independent work which would otherwise be done, but some theodolite observations will be taken.

The topographical camera presented to the Club by Mrs. Jared Sparks has been loaned for the months of June and July to Major J. M. Gould of the White Mountain Club, Portland, Me.

Reports of the Councillors for the Spring of 1880.

Exploration.

By W. H. Pickering.

The White Mountain region has been so thoroughly explored during the past few years, that the Department feels the scope of its work very rapidly diminishing. But in the regions adjacent, especially to the north and northeast, a good deal still remains to be done, and to these localities I shall first call your attention. (1.) The Northumberland region, including the Percy Peaks, Cape Horn, and other less known summits. (2.) The Dixville Notch. The scenery about here is very picturesque, the mountains are comparatively unknown, and the vicinity includes several natural curiosities, such as an ice cave, several cascades, and the inevitable profile. (3.) The Grafton Notch. This and the next are perhaps the most attractive localities of all. The mountains rise to heights of nearly

4,000 feet, the scenery is magnificent, and the whole region is almost unknown. (4.) The mountains about Phillips, Me. These include Mts. Blue, Abraham, Saddleback, and numerous others; all near together, surrounded by primeval forests, and crowned with craggy ledges and boulders. (5.) Moosehead Lake and the mountains beyond. It is expected that the Club will be represented in one or more of these regions this summer, and the Department hopes that we shall hear something of interest from them in the autumn.

Returning now to the White Mountains proper, I give below a list of the more important of their less-visited peaks, together with their elevations and references.

TABLE OF THE LESS-VISITED PEAKS OF THE WHITE MOUNTAINS.

No.	Name.	Elevation in Feet.	Described.
1.	Bald (Shelburne)	4,400	
2.	Imp	4,000	
3.	Carter	4,700	
4.	Carter Dome	4,830	Appalachia, I. 76.
5.	Wildcat	4,350	
6.	Royce	2,600	
7.	Baldface, North	3,600	Appalachia, II. 163.
8.	Baldface, South	3,600	" "
9.	Eastman	3,470	" "
10.	Montalban Ridge	4,000–5,000	
11.	Rocky Branch Ridge	3,000–5,000	
12.	Giant's Stairs	3,500	Appalachia, I. 121.
13.	Resolution	3,400	" "
14.	Crawford	3,130	" "
15.	Jackson	4,100	" "
16.	Webster	4,000	
17.	Willey	4,330	Appalachia, I. 120.
18.	Nancy	3,800	
19.	Anderson	4,000	Appalachia, II. 164.
20.	Lowell	3,850	" "
21.	Tremont	3,400	" I. 124.
22.	Silver Spring	3,000	
23.	Bear	3,000	
24.	Passaconaway	4,200	Osgood's Guide, 337.
25.	Tripyramid	4,100	Appalachia, I. 14.
26.	Twin, North	5,000	
27.	Twin, South	5,000	
28.	Hale	3,400	

No.	Name.	Elevation in Feet.	Described.
29.	Guyot	4,600	Appalachia, I. 29.
30.	Bond	4,700	" "
31.	Hancock	4,420	" II. 164.
32.	Liberty	4,500	" I. 122.
33.	Flume	4,500	Osgood's Guide, 274.
34.	Kinsman	4,200	Appalachia, II. 168.
35.	Moosilauke (from the east) .	4,800	

It will be noticed, that, out of the thirty-five mountains mentioned, eleven have been previously described in APPALACHIA, and seven more are described in this number. Brief accounts of all the remaining mountains are given in Osgood's "White Mountain Guide Book," but in two cases only are they sufficiently explicit to be of much service to the Club; and it is hoped that, before many summers, not one of these mountains will be found without an APPALACHIA reference attached to it.

An account of any mountain walk should include the three following topics: —

(1.) A description of the route, together with times, distances, and elevations. If no observations were made, a rough estimate of the distance, and the number of hours required; should be given.

(2.) Describe the situations where water may be found, and their probable reliability in dry weather. If no water was discovered, particular mention should be made of the fact. Note also any natural curiosities or points of view on the way.

(3.) Describe the character of the summit, whether composed of ledge, boulders, sand, lawn, scrub, or trees. Also the kind, direction, and extent of obstructions to the view, together with any valuable information pertaining thereto.

Reports of the Councillors for the Spring of 1880.

Improvements.

BY A. E. SCOTT.

THE Councillor in this department might well content himself, by way of recommendation for the summer's work, in referring to the vast amount of unfinished improvements suggested by his predecessors.

We remember with what interest we listened to the report of our first Councillor in this department, in the spring of 1876, and with what enthusiasm we looked forward to the November meeting, picturing in our minds a report of twenty smooth paths, eight feet wide, free from trip roots, the trees along their sides spotted with the Club hatchet, and the rocks on the mountain-tops blazing with "A. M. C." And, while we look back with pride on the work that has been accomplished from year to year, our experience forces us to admit, that wielding an axe on a mountain-side, or lugging stones on the ledges with which to build cairns, in midsummer, has a cooling effect on one's ardor in path-building, if not on the temperature of one's body; and that the many so-called improvements must be accomplished slowly, and by hard labor.

Individual members may accomplish something with their own hands, as has been done in the regions about North Conway and Waterville; but the season is so short, and much of the work so severe, that we must rely chiefly on labor obtained near the localities selected for improvements.

In this particular, this department is at a disadvantage. Strong legs and keen eyes are about the only necessities of the Councillor in the department of Exploration; the Councillors in the departments of Art and Natural History cannot fail to find material for a season's work in any locality, and members can render great assistance without special effort, and the skill of a single individual can accomplish very much in the department of Topography. But the department of Improvements requires days of hard toil, — labor prompted by something more substantial than love for the object.

In the present state of our treasury, the Council is not likely to place a large fund at the disposal of any department, and the improvements hitherto made by the Club have generally been in vicinities frequented by people who have contributed largely to meet the expense, or where private interests have prompted generous subscriptions; so that I approach the work of the season with considerable misgiving, and will only call the attention of the Club to one or two localities familiar to all, and already referred to in previous reports, and venture to suggest but a single new project for consideration. While I

specially refer to few plans for the summer's work, hoping that the modesty of my recommendations will insure their adoption and execution, I earnestly urge each member to do what he can in the locality where he may happen to be during the summer, not only in carrying out the plans already suggested, but also in opening new fields, making new paths, and clearing view points at different elevations; and I trust it will be well received if I suggest that, where it is not possible to build a path according to the regulations laid down in the early proceedings of the Club, one that does not strictly conform to them, or even a trail merely spotted through an unknown forest, may do good service.

The Club should make special effort from year to year to keep the paths and camps it has constructed in good condition. A path overgrown or imperfectly marked will soon fall into disuse. One of the most important improvements credited to our Club is the Mt. Adams path and camp, and the branch path into King's Ravine. Many members of the Club, and others, have availed themselves of both camp and paths in exploring these localities, previously rarely visited. The paths were kept in good condition during the last season, but a clearing made below, for the purposes of a look-out, exposed the camp to the full force of the storms, and it was demolished. I earnestly recommend the rebuilding of this, our first camp, and the completion of the camp long ago begun in King's Ravine. A good shelter in this ravine will do much to attract visitors to this wonderful locality, and render further explorations practicable.

In connection with the Mt. Adams path, I wish to urge the construction of a branch path, from a point near the camp, across the ridge to the Ravine of the Cascades. A line has already been spotted, by our good friend Mr. Lowe, to the upper fall, and a path can be made, without great expense, branching from this line so as to enter the ravine at the lower fall, pass up over the succession of cascades, and return by the route above indicated. Such a path would open one of the most beautiful ravines in the whole mountain region.

I cannot leave this side of the Great Range without referring to the Castellated Ridge.

I think the time is not far distant when a path will be constructed over this ridge to the summit of Jefferson. The most feasible route seems to be along the easterly side of Mt. Bowman, and thence directly up the sharp ridge to the lower castle. Such a path would furnish a short route to the summit of Washington, afford means of escape in case of a sudden storm on Jefferson, and render accessible this remarkable region, now but little known. It seems desirable that the Club should be identified with this project.

A path has been long contemplated to make the interesting region about Mt. Moosilauke more accessible from the Pemigewasset valley. It is believed that the work can be done at slight expense, by taking advantage of logging-roads already cut at each end of the route. The course suggested would run from the stage road at West Thornton, for perhaps two miles, by a good highway, and then by a logging-road along Hubbard Brook, to the end of a very remarkable gorge. The path to be constructed would continue from this point still along the brook, and then across the divide between Mts. Kineo and Cushman to other logging-roads, which lead in from the highway near Merrill's, at the foot of the Moosilauke carriage-road. The actual route has not been fully explored, but it is believed that the distance to be cut will not exceed four miles. The path partially constructed last season by the people of Warren does not render this any the less desirable, as that serves rather the upper Pemigewasset valley, and is not available to parties coming from Campton, Thornton, and Waterville. I am anxious that the Club should move in this enterprise at once, so that the path may be ready for use during the coming season.

My attention was called, during the past year, to the Swift River intervale, and in connection with it to Tripyramid. The intervale is near the head of the Swift River valley, at the base of grand mountains, in the midst of fine views, and near many objects of interest. A single highway leads up the river from Conway, through the township of Albany, ten or twelve miles, ending at a place called Shackford's, — a large farm-house, where an occasional tourist is entertained. This highway is now the only means of access, but a road is projected, and may possibly be built during the present year,

from Upper Bartlett to this valley, probably running between Silver Spring and Bear Mts., which will bring the intervale much nearer railway communication.

Sabba Day Brook, a wild and powerful stream, flows into the Swift River near Shackford's, and Church's Falls are not far from its mouth. The falls are wild and beautiful, and of great interest geologically. The stream flows through the ravine between Passaconaway and Tripyramid, and the climb from the falls to either summit of the latter cannot be very difficult. The view from Tripyramid, now obtained by climbing trees, is very fine. It is in the midst of the great Sandwich Group, and near the immense mountain masses in the Pemigewasset Forest. It commands the Franconia and White Mountain ranges, and in the south the lovely lake region of New Hampshire. The summits of the south and central peaks can be easily cleared, thus affording unobstructed views. The distance between these peaks is short, and a path can be cut without great difficulty. On the south peak is the track of the great slide of 1869, reaching nearly to the summit. I have briefly mentioned these various attractions for the purpose of leading up to the following recommendations, viz.: the clearing of the summits of the south and central peaks of Tripyramid, the construction of a path from the top of the slide to the south peak, thence across to the central peak, and from one of these summits, following the ravine of Sabba Day Brook, by Church's Falls, to Shackford's. Such a path would connect two beautiful valleys, and, when the road referred to is built, will be an exceedingly interesting route from Waterville to Bartlett,—far more attractive than the American Institute path, built last year.

This department is assured by Mr. Greeley, of Waterville, of the completion of the path, begun last season, over Noon and Jennings Peaks to the summit of Black Mountain, and, possibly, of some assistance in clearing the summit of Tripyramid.

At North Conway, the Messrs. Worcester will complete the path over Mt. Bartlett, to Kearsarge.

I regret to learn that the sufferance of the path across the Intervale, leading over the foot-bridge, built by the same ener-

getic members of our Club, is not likely to continue. I bespeak the influence of the Club to secure to the public some means for crossiug the Saco at this point.

The Moat path has been completed to the south peak; so that it is now easy to traverse the whole range, passing up the north peak in Bartlett and descending the south peak into Albany. This work has been carefully done, and more paths may seem unnecessary, but the various ridges that stretch out towards the east are full of interest. The Red and Central Ridges are for the most part bare ledges and easily climbed, the only difficulty being at the abrupt precipices at their extremities. A safe path may be easily made near the end of the Red Ridge; and I suggest a path leading from the clearing near the White Horse Ledge, through a track of magnificent beech timber, to Thompson's Falls, — a locality not now fully appreciated, — and thence to the foot of this ridge. Logging-roads may be followed a great part of the distance, and cutting will only be necessary near the falls and the end of the ridge. A good path now leads down the Central Ridge on the southerly side, and thence through the forest to a succession of clearings that extend along the base of the south peak; but this leads one many miles from North Conway, and away from the immense cliffs at the end of the ridge. I suggest a path through the woods, from the great pasture in Hale's Location to the base of these cliffs, and that some way be marked where the cliffs may be climbed in safety. The distance is not great, and wood roads may be followed a part of the way.

I am assured by my predecessor that he will assume the responsibility of measuring and marking the paths which came under the care of this department last year, and of his hearty co-operation in other work.

Officers for 1880.

President,

Prof. CHARLES R. CROSS, Mass. Inst. Technology, Boston, Mass.

Vice-President,

PROF. EDWARD S. MORSE, Salem, Mass.

Recording Secretary,

J. B. HENCK, JR., Mass. Inst. of Technology, Boston, Mass.

Corresponding Secretary,

REST F. CURTIS, 16 Beethoven St., Jamaica Plain, Mass.

Treasurer,

CHARLES W. FOLSOM, 19 Berkeley St., Cambridge, Mass.

Councillors:

Natural History, PROF. J. H. HUNTINGTON, Box 1914, Boston, Mass.
Topography, PROF. WILLIAM H. NILES, Cambridge, Mass.
Art, MRS. PHEBE M. KENDALL, 123 Inman St., Cambridgeport, Mass.
Exploration, W. H. PICKERING, 84 Mt. Vernon St., Boston, Mass.
Improvements, A. E. SCOTT, Lexington, Mass.

Members Added since June 25, 1879.

Adams, Edwin L., Boston, Mass.
Atkins, Mrs. Elisha, Boston, Mass.
Atwood, E. S., Salem, Mass.

Bailey, Alvin R., Somerville, Mass.
Boardman, Mrs. Wm. D., Roxbury, Mass.
Bowker, R. R., New York, N. Y.
Bradley, W. H., Boston, Mass.
Briggs, Francis C., Hampton, Va.
Brigham, Miss A. A., Boston, Mass.
Brigham, Miss Helen F., Boston, Mass.
Buckley, J. M., Brooklyn, N. Y.
Burt, Frank H., Springfield, Mass.

Caroll, Miss Annie B., Dedham, Mass.
Caroll, Miss Jennie C., Dedham, Mass.
Chamberlin, E. D., Boston, Mass.
Champney, Benjamin, Woburn, Mass.
Chubbuck, Isaac Y., Roxbury, Mass.
Clark, C. Goodwin, South Boston, Mass.
Clarke, Samuel B., Salem, Mass.
Cochran, Fred. B., Boston, Mass.
Collamore, Miss Helen, Boston, Mass.

Congdon, Miss Alice E., New Brighton, N. Y.
Crane, C. B., Roxbury, Mass.

Dame, Miss Lydia M., Lynn, Mass.

Eldredge, George H., Nahant, Mass.
Estabrooks, J. A., Boston, Mass.

Folsom, Norton, Cambridge, Mass.
Foote, George L., Boston, Mass.
Foster, C. C., Cambridge, Mass.
Freeman, Miss Harriet E., Boston, Mass.
Frost, Miss Bertha, Woburn, Mass.

George, Frank, Upper Bartlett, N. H.

Harris, Mrs. Abbie F., Lynn, Mass.
Heath, Daniel C., Boston, Mass.
Hunt, Freeman, Cambridge, Mass.

Josselyn, Miss Lizzie J., Boston, Mass.

Knowlton, W. J., Boston, Mass.

Learned, Miss Georgie D., Boston, Mass.
Lewis, Miss Evangeline, Boston, Mass.
Lobdell, Miss E. S., Boston, Mass.
Lombard, Miss Annie S., Boston, Mass.
Lund, Chas. C., Concord, N. H.

McNicol, J. A., Hanover, N. H.
McPhaill, Miss S. E., Boston, Mass.
Merrill, E. L., Boston, Mass.
Mitchell, Henry, Boston, Mass.
Murdock, Harold, Boston, Mass.

Newhall, Miss Lucy M., Boston, Mass.

Ordway, John M., Boston, Mass.
Osborne, Geo. A., Boston, Mass.

Packard, E. N., Dorchester, Mass.
Packard, Mrs. M. E., Dorchester, Mass.
Pitman, Miss H. M., Somerville, Mass.
Pope, Miss Louisa B., Cambridge, Mass.
Prince, John T., Waltham, Mass.

Richards, Robert H., Boston, Mass.
Russell, Levi W., Providence, R. I.

Safford, Dr. Mary J., Boston, Mass.
Sawyer, J. H., Lowell, Mass.
Spalding, F. R., Boston, Mass.
Stimpson, Miss Kate F., Boston, Mass.
Stone, Miss Ellen A., East Lexington, Mass.
Stone, Miss M. Isabella, Framingham, Mass.

Tappan, Lewis Wm., Jr., Boston, Mass.
Tuttle, Julius H., Dedham, Mass.

Verne, Bernard P., Boston, Mass.

Ware, Wm. R., Boston, Mass.
Weeks, T. W., Brooklyn, N. Y.
Wells, James A., Cambridge, Mass.
West, Arthur W., Salem, Mass.
Willard, Joseph, Boston, Mass.
Willson, Robert W., Cambridge, Mass.
Winship, A. E., Somerville, Mass.
Woodbury, Charles L., Boston, Mass.
Woods, Andrew, Winchester, Mass.
Wright, G. Frederick, Andover, Mass.

Proceedings of the Club.

June 11, 1879. — Thirteenth Corporate Meeting.

President Niles in the chair.

Prof. E. C. Pickering moved the appointment of a committee to investigate the names of mountains, the true names of which were in doubt, and report the various names with the authorities for them. The motion was passed, and the chair appointed Prof. E. C. Pickering, Mr. C. W. Folsom, and Prof. C. E. Fay.

Mr. C. W. Folsom read a paper on Elementary Surveying for Amateurs.

Mr. J. B. Henck, Jr. exhibited and explained several forms of pedometer.

Prof. Charles R. Cross was appointed a delegate to the International Congress of Alpine Clubs, to be held in Geneva, Switzerland, in August.

June 21, 1879. — A party of about 125 ladies and gentlemen made an excursion to Mt. Wachusett, Princeton, Mass.

July 9, 1879. — Seventh Field Meeting.

Held at the Crawford House, White Mountains, N. H.

President Niles in the chair.

A paper on Mt. Carrigain, by Prof. Charles E. Fay, was read, in the absence of the author, by Mr. W. H. Ladd. (See p. 108.)

Prof. Charles H. Hitchcock described the Geology of the White Mountain Notch, and the probable method of its formation.

Dr. F. V. Hayden made some remarks on the Rocky Mountains as compared with the White Mountains.

Prof. F. W. Clarke presented some notes on the mountains of North Carolina, supplementing his paper on these mountains, APPALACHIA, II. 14.

July 10, 1879. — A party of thirty ladies and gentlemen ascended Mt. Carrigain.

July 11, 1879. — A party of eleven ladies and gentlemen walked through from Livermore to Waterville, N. H. This excursion and the previous one were made by the paths recently opened under direction of the Club by the aid of funds subscribed by members of the American Institute of Instruction.

August 20, 1879. — Eighth Field Meeting.

Held at Greeley's Mountain House, Waterville, N. H.

President Niles in the chair.

Mr. Webster Wells was appointed Secretary *pro tem.*

Hon. J. W. Bacon, on the part of the guests, welcomed the Club to the House.

President Niles, in response, spoke briefly of the objects and character of the Club.

Rev. J. M. Buckley, D. D., read a paper giving a Comparative View of the Natural Scenery of the United States and of Europe.

Mrs. L. D. Pychowska read a paper on Baldcap Mountain. (See p. 121.)

Mrs. Pychowska also read some Notes of a Visit to the Falls on Copper Mine Brook, near Franconia, N. H., Sept. 27, 1878, and a poem entitled "A Warning," both by Miss E. W. Cook.

Prof. Charles E. Fay read a paper on the Tripyramid Slide, written by Mr. Charles Cutter, of Campton, N. H.

A recess of two hours for dinner was then taken.

The meeting was called to order again at three o'clock, and a discussion on the causes of the Tripyramid Slide was participated in by Judge Bacon, Prof. Fay, and others.

A poem on the Roses at Beckytown, by Mrs. M. E. McKaye, was read by Mrs. A. L. Goodrich.

Prof. Fay called attention to the interesting field for exploration in the vicinity of Waterville, in relation to a possible interpretation of the journal of Samuel Willard.

Mr. W. H. Pickering gave an account of a Three Days' Tramp on the Mt. Washington Range. (See p. 117.)

Mrs. Pychowska read a paper on Mts. Success (Ingalls) and Goose Eye, by Miss Pychowska.

August 27, 1879. — Ninth Field Meeting.

Held at Rev. John Worcester's Study, North Conway, N. H.

Vice-President Worcester in the chair.

Mr. W. H. Pickering repeated the account of his walk on the Mt. Washington Range, as given at Waterville.

Mr. Worcester read a paper on the Local Names of the Mountains.

Rev. Henry A. Parker read a paper on the Changes in the Saco River caused by Freshets.

Dr. W. B. Parker described the paths recently constructed by the Club.

Mr. J. R. Edmands called attention to the map of the White Mountains issued by the Eastern Railroad, in connection with their time-tables.

Mr. E. C. Eastman made some remarks on the various maps of the White Mountains.

Mr. Markinfield Addey showed some photographs of the Bridal Veil Falls on Copper Mine Brook, and spoke of the expedition from the office of the White Mountain Echo, which had recently explored and brought them to public notice.

At 3:30 P. M. the same day, an informal meeting was held, at which various matters of topographical interest were discussed.

August 28, 1879. — A party of about one hundred ladies and gentlemen made an excursion to Tuckerman's Ravine, ascending from the Crystal Cascade by a path recently opened by the Club.

October 8, 1879. — Fourteenth Corporate Meeting.

President Niles in the chair.

Mr. Webster Wells read a paper describing the mountain paths about Waterville, N. H., especially those opened the past season.

Prof. Chas. E. Fay described the connection of the Portland [Me.] White Mountain Club with Mt. Carrigain.

Prof. Archibald Geikie, of Edinburgh, spoke of the glacial drift on the eastern slope of the Rocky Mountains.

Prof. Geikie also spoke of the death of the geographer, Mr. Keith Johnson.

The President gave a sketch of the life and mountain studies of the late M. Viollet-le-Duc.

He also mentioned the successful termination of the Nordenskjöld expedition, and spoke of the death of Dr. Moseley by an accident while climbing among the Alps, the cause being neglect of the usual safeguard of the alpine-rope.

Attention was called to two large wall-maps of Japan, presented to the Club by the Department of Education at Tokio.

Persons having spare copies of APPALACHIA, Vol. I. No. 1, were requested to return them to the Club, as the supply was running short.

November 12, 1879. — Fifteenth Corporate Meeting.

President Niles in the chair.

On motion of Mr. Frederic Gardiner, Jr., a committee, consisting of Prof. Fay, Mr. R. F. Curtis, Mrs. Kendall, Miss Pitman, and Miss Littlehale, was appointed to make arrangements for a social soirée.

Mr. J. Rayner Edmands presented his report as Councillor of Topography.

Prof. E. T. Quimby spoke of the work of the U. S. Geodetic Survey in New Hampshire during the last summer, and asked for information concerning a heliotrope signal from some unknown source in Bethel, Me. He also made some remarks on the method of describing the location

and ways of reaching stations which have been marked and signalled from.

Mr. Edmands moved the appointment of a committee to consider improvements in the system of heliotroping. The motion was passed, and Prof. E. C. Pickering, Mr. Robert W. Willson, and Mr. Edmands were appointed.

Prof. Chas. E. Fay presented his report as Councillor of Exploration.

Prof. Quimby described the path which the Geodetic Survey had opened to the summit of Mt. Moriah, and mentioned a remarkable boulder (see p. 159) on the side of the mountain, to which a branch path had been made.

Dr. W. B. Parker presented his report as Councillor of Improvements. (See p. 170.)

Mr. S. H. Scudder described his measurement and marking of the Mt. Adams path during the last summer. (See p. 175.)

Rev. John Worcester read a paper describing the excursion to Tuckerman's Ravine made from North Conway, N. H., August 28th last.

Prof. Charles R. Cross gave an account of the proceedings of the Conference of Alpine Clubs, held at Geneva in August last, which he attended as the representative of the Club.

On motion of Prof. Fay a vote of thanks was tendered to Prof. Cross for his efforts on behalf of the Club on that occasion.

December 10, 1879. — Sixteenth Corporate Meeting.

President Niles in the chair.

Prof. Fay, for the committee of arrangements, reported that arrangements had been made to hold a social soirée at the Revere House, Boston, on Thursday evening, January 8, 1880.

The President, for a committee of the Council, called the attention of the Club to the common disfigurement of natural scenery by advertisements, &c., and the desirability of preserving many objects of scientific interest, such as boulders, &c., from destruction or removal; and said that the Council had approved the suggestion that a committee be appointed to represent the Club in such measures as might properly be taken to prevent such disfigurement or destruction.

On motion of Mr. C. W. Folsom, the following persons, nominated by the committee of the Council, were appointed as members of the proposed committee of the Club: — Prof. William H. Brewer, New Haven, Conn.; Mr. James T. Gardner, Albany, N. Y.; Prof. Arthur Lakes, Golden, Col.; Dr. R. H. Lamborn, Colorado Springs, Col.; Prof. Albert H. Tuttle, Columbus, O.; Prof. Charles H. Hitchcock, Hanover, N. H.; Prof. B. K. Emerson, Amherst, Mass.; Prof. Maria Mitchell, Poughkeepsie, N. Y.; Mr. George F. Morse, Portland, Me.; Mrs. L. D. Pychowska and Mr. Eugene B. Cook, Hoboken, N. J.; Rev. Henry A. Parker, North Conway, N. H.; Mr. Charles E. Lowe, Randolph, N. H.; Rev. Francis

M. Bacon, New York; Mr. Edwin S. Balch, Philadelphia; Capt. C. O. Boutelle, Norfolk, Va.; Prof. F. W. Clarke, Cincinnati, O.; Rev. C. A. L. Richards and Mr. William W. Bailey, Providence, R. I.; Miss Grace P. Appleton, Roxbury, Mass.; Mr. James R. Carret, Boston; Mr. S. E. D. Currier, Boston; Mr. Chas. W. Folsom and Mr. Joshua Kendall, Cambridge, Mass.; Mr. Jervis McEntee, Rondout, N. Y.; Rev. E. G. Porter and Mr. A. E. Scott, Lexington, Mass.; Rev. Edward A. Rand, South Boston, Mass.; Mr. Samuel H. Scudder, Cambridge, Mass.; Rev. H. G. Spaulding, Springfield, Mass.; Mr. M. F. Sweetser, Boston; Rev. John Worcester, Newtonville, Mass.

Prof. Edward S. Morse described the large maps of Japan, recently received from the Department of Education at Tokio, and presented some interesting notes on the origin of the Japanese people and their modes of life.

Prof. J. H. Huntington presented his report as Councillor of Natural History. (See p. 158.)

Mrs. Phebe M. Kendall presented her report as Councillor of Art.

A paper on the Topography of the Catskill Mountains, by Prof. Arnold Guyot, accompanying a copy of his recent map of that region presented by him to the Club, was read by President Niles. (See p. 97.)

A vote of thanks was tendered to Prof. Guyot for the map and his interesting paper.

Prof. E. C. Pickering spoke of a library which had been started at Jackson, N. H., by Mr. J. K. Porter and other guests of the Thorn-Mountain House, and which had since been established as a public library for the town; and suggested that members of the Club might do a good work in encouraging the establishment of similar libraries elsewhere. On motion of Prof. Pickering, it was voted to present a bound copy of APPALACHIA, Vol. I., to the Jackson library.

Messrs. Samuel H. Scudder, Webster Wells, and R. F. Curtis were appointed a committee to report nominations for the various offices of the Club to be filled at the next meeting.

January 8, 1880. — A social soirée was held at the Revere House, Boston.

January 14, 1880. — Seventeenth Corporate Meeting.

President Niles in the chair.

The following officers were elected for the ensuing year: — President, Prof. Charles R. Cross; Vice-President, Prof. Edward S. Morse; Secretary, Mr. J. B. Henck, Jr.; Treasurer, Mr. C. W. Folsom. Councillors: Natural History, Prof. J. H. Huntington; Topography, Prof. William H. Niles; Art, Mrs. Phebe M. Kendall; Exploration, Mr. W. H. Pickering; Improvements, Mr. A. E. Scott.

President Cross then took the chair, and retiring President Niles delivered the annual address.

A vote of thanks was passed to Prof. Niles for the efficient performance of his duties during the past year, and for his interesting address, and he was requested to furnish a copy of the latter for printing.

The Secretary and Treasurer then presented their annual reports. (See pp. 152, 154.)

Mr. J. R. Edmands gave an account of some important work in the identification of mountains visible from Portland, Me., which had been done by members of the Portland White Mountain Club.

The Secretary called attention to several maps of the Yellowstone National Park, and adjacent regions, made by the survey under the direction of Dr. Hayden, and by him presented to the Club.

February 11, 1880. — Eighteenth Corporate Meeting.

President Cross in the chair.

The Secretary read a letter from Mr. George F. Hammond, offering to give a free course of lessons in sketching to any eight members of the Club who would make the knowledge gained of use to the Club. A vote of thanks to Mr. Hammond was passed.

Prof. E. C. Pickering described his observations on the variable refraction of the atmosphere, made for the purpose of discovering, if possible, the laws governing the observed variations.

Mr. W. H. Pickering read a paper on Future Arctic Explorations, illustrated by a map of the Arctic Zone, which he had prepared for the purpose of showing the relative advantages of various routes of approach to the Pole.

March 10, 1880. — Nineteenth Corporate Meeting.

President Cross in the Chair.

Mr. Warren Upham read a paper on the Topography of Western Minnesota.

Prof. William B. Rogers described the structure of the Great Appalachian Valley in the States of Pennsylvania and Virginia, illustrating his description by the geological maps of those States, prepared respectively by Prof. Henry D. Rogers and by himself, and a portion of the new map of Pennsylvania now being prepared by the present State Survey, under direction of Prof. Lesley.

Prof. W. H. Niles made some remarks on the work of Profs. William B. and Henry D. Rogers, in making the first accurate geological survey made in this country, and spoke also of the present survey of Pennsylvania.

Prof. J. H. Huntington read a paper describing the progress and methods of Early Mining in the Appalachian Gold Fields.

The Secretary, on behalf of the Councillor of Art, spoke of Mr. George F. Hammond's offer of free instruction in sketching to a limited number

of members of the Club, and asked those wishing to join the class to give him their names at the close of the meeting.

April 14, 1880. — Twentieth Corporate Meeting.

President Cross in the chair.

The President called attention to the fact that a new edition of Osgood's White Mountain Guide Book was to be issued, with complete revision of the text.

Prof. W. H. Niles called attention to a small painting by Miss Cook, of Hoboken, N. J., and read a note from her presenting it to the Club.

The following amendments to the By-Laws were proposed: —

1. Amend ART. V. by making the last sentence read: "The President and Vice-President shall not be eligible for more than two consecutive years," &c.

2. Amend ART. XII. to read: "Regular meetings of the Club shall be held every month, excepting July, August, and September. The January meeting shall be the annual meeting, and shall be held on the afternoon of the second Wednesday of that month. Field meetings shall be held at such times and places as the Council may determine. Eleven members shall form a quorum for business."

After some discussion the first amendment was rejected, and the second was referred back to the Council, with request to report at the next meeting.

Miss Alice C. Fletcher read a paper on the Pre-Historic Nations of the Ohio Valley, illustrated by diagrams of some of the principal tumuli and fortifications.

May 12, 1880. — Twenty-first Corporate Meeting.

President Cross in the chair.

Amendments to the By-Laws were discussed as follows: —

It was proposed to amend ART. XII. to read: "The Council shall call a regular meeting of the Club in Boston in each month, excepting July, August, and September; also, special and field meetings at such times and places as may seem advisable. The January meeting shall be the annual meeting, and shall be held on the afternoon of the second Wednesday of that month. Eleven members shall form a quorum for business."

Mr. Currier presented a substitute, which, after some discussion was rejected. The article, in the above form, was then passed to a second reading.

In order to divide the work of the Secretary it was proposed to amend the necessary articles of the By-Laws to read as follows: —

"ART. IV. The officers of the Club shall be a President, Vice-President, Recording Secretary, Corresponding Secretary, Treasurer, and five

Councillors. These officers shall form a governing board, to be termed the Council."

Passed to a second reading.

"ART. III. . . . . Nominations shall be made in writing, by at least two members, and forwarded to the Council. Should the Council approve the nomination, it shall be announced at the next regular meeting, and balloting shall take place at the succeeding regular meeting," &c.

The Council, through the President, proposed to amend by inserting the word "next" before "succeeding." This was rejected, and the above form passed to a second reading.

"ART. V. . . . . but any vacancy may be filled by a new election in the same manner, at any regular meeting, five days' notice of the election having been given. The President," &c.

Passed to a second reading.

"ART. VII. The Recording Secretary shall be the Clerk of the Corporation, keep a record of all the proceedings of the Club and Council, give notice to members of the time and place of meetings, have charge of the library, pictures, documents, muniments of title, and the corporate seal; and shall present, at the annual meeting, a history of the Club during the previous year. The Corresponding Secretary shall conduct the official correspondence of the Club."

The Council proposed to amend by inserting the words "and shall" before "keep a record," &c., which was adopted.

Mr. Folsom moved to amend by making the last sentence read: "The Corresponding Secretary shall conduct the official correspondence of the Club, shall keep proper files and records of the same, and shall make a report for the previous year at the annual meeting."

The amendment was adopted, and the proposed form, as amended, was passed to a second reading.

"ART. IX. All official notices by the Recording Secretary and Treasurer," &c.

Passed to a second reading.

"ART. XIII. . . . . shall be certified in writing by the Treasurer to the Recording Secretary," &c.

Passed to a second reading.

ART. XVI. Omit final words "by the Secretary."

Passed to a second reading.

Prof. J. H. Huntington presented his report as Councillor of Natural History. (See p. 177.)

Mr. A. E. Scott presented his report as Councillor of Improvements. (See p. 183.)

Prof. W. H. Niles presented his report as Councillor of Topography. (See p. 179.)

Mr. W. H. Pickering presented his report as Councillor of Exploration. (See p. 181.)

The Secretary read a letter from the Middlesex Scientific Field Club, proposing the name "Middlesex Fells" for the wooded region lying in

the towns of Malden, Medford, Winchester, Woburn, Stoneham, and Melrose; and requesting a recognition of the name by the Club. The matter was referred to a committee of three, consisting of Mr. A. E. Scott, Prof. C. E. Fay, and Prof. E. C. Pickering.

May 22, 1880. — A party of forty-six persons made an excursion to the Cascade, in Melrose, and thence to Spot Pond.

June 9, 1880. — Twenty-second Corporate Meeting.

President Cross in the chair.

The following amendments to the By-Laws, which passed their first reading at the last meeting, were then voted upon, article by article, and adopted without debate :—

Amend Art. XII. to read: "The Council shall call a regular meeting of the Club in Boston in each month, excepting July, August, and September; also, special and field meetings at such times and places as may seem advisable. The January meeting shall be the annual meeting, and shall be held on the afternoon of the second Wednesday of that month. Eleven members shall form a quorum for business."

"Art. III. . . . . Nominations shall be made in writing, by at least two members, and forwarded to the Council. Should the Council approve the nomination, it shall be announced at the next regular meeting, and balloting shall take place at the succeeding regular meeting," &c.

"Art. IV. The officers of the Club shall be a President, Vice-President, Recording Secretary, Corresponding Secretary, Treasurer, and five Councillors. These officers shall form a governing board, to be termed the Council.

"Art. V. . . . . but any vacancy may be filled by a new election in the same manner, at any regular meeting, five days' notice of the election having been given. The President," &c.

"Art. VII. The Recording Secretary shall be the Clerk of the Corporation, and shall keep a record of all the proceedings of the Club and Council, give notice to members of the time and place of meetings, have charge of the library, pictures, documents, muniments of title, and the corporate seal; and shall present, at the annual meeting, a history of the Club during the previous year. The Corresponding Secretary shall conduct the official correspondence of the Club, shall keep proper files and records of the same, and shall make a report for the previous year at the annual meeting."

"Art. IX. All official notices by the Recording Secretary and Treasurer," &c.

"Art. XIII. . . . . shall be certified in writing by the Treasurer to the Recording Secretary," &c.

Art. XVI. Omit final words "by the Secretary."

On motion of Mr. Currier it was voted: That, until otherwise ordered, the regular meetings of the Club shall be held on the afternoon of the

second Wednesday of the month; but the Council shall fix a different time for any particular meeting when the interests of the Club so require.

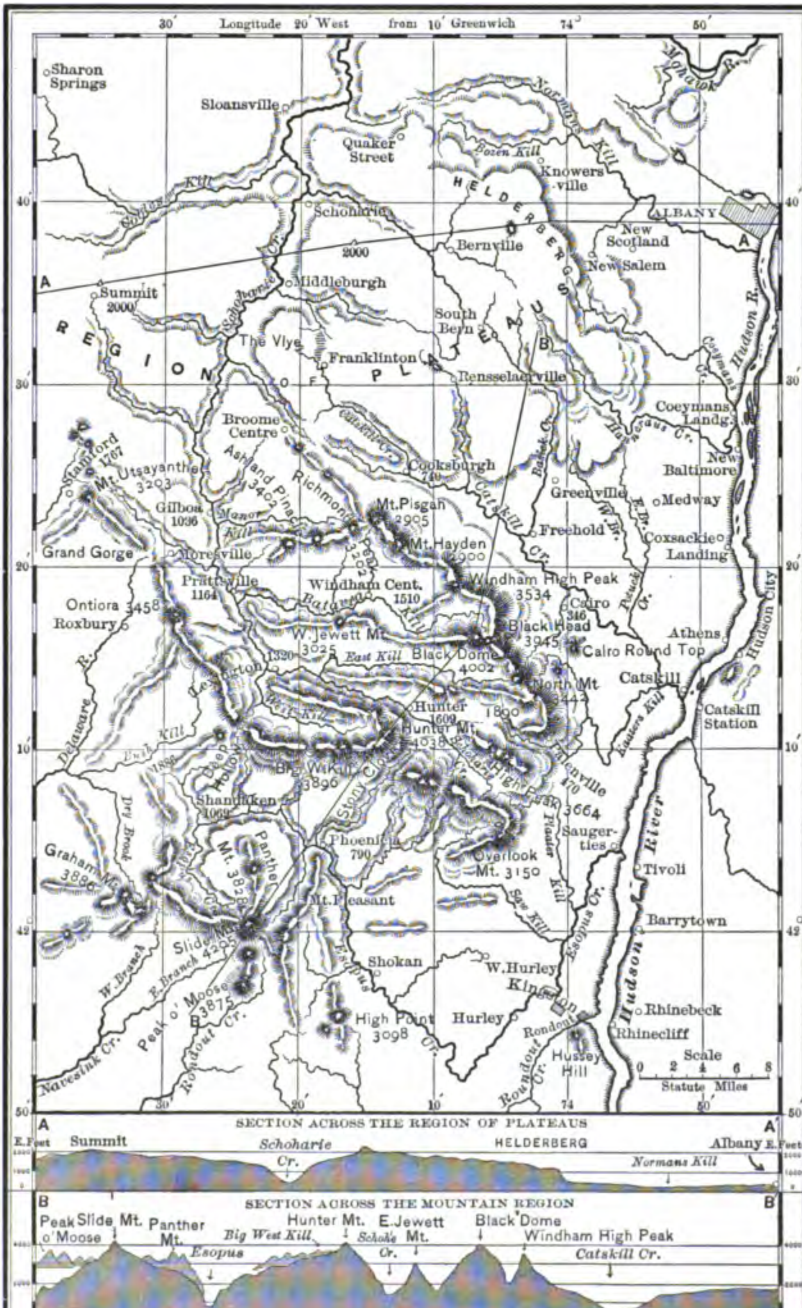
Under the amended By-Laws, Mr. J. B. Henck, Jr. was elected Recording Secretary, and Mr. Rest F. Curtis, Corresponding Secretary.

Prof. Charles E. Fay read an account of a Visit to the White Mountains in 1844, by Dr. H. Ballou, 2d, originally published in the Universalist Quarterly.

Prof. W. H. Niles gave an account of several ascents of important peaks among the Andes recently made by Mr. Edward Whymper.

The Secretary read from the New York Weekly Herald of May 29, 1880, an account of a Quiet Sunday Stroll, by John Habberton, being an account of the adventures of two young men who set out from the summit of Mt. Washington in the afternoon, and were overtaken by night before getting down.

June 19, 1880. — A party of seventy persons made an excursion to the summit of Mt. Monadnock.


Longitude 20' West from 10' Greenwich
Sharon Springs
Sloansville
Quaker Street
Knowers-ville
HELDERBERGS
ALBANY
Schoharie
Bernville
New Scotland
New Salem
Summit 2000
Middleburgh
REGION OF PLATEAUS
South Bern
The Vlye
Franklinton
Rensselaerville
Hudson R.
Coeymans Landg.
Broome Centre
Cooksburgh
New Baltimore
Medway
Greenville
Freehold
Coxsackie Landing
Mt. Pisgah 2905
Mt. Hayden 2900
Stamford 1767
Mt. Utsayanthe 3203
Gilboa 1036
Grand Gorge
Moresville
Prattsville 1164
Windham Cent. 1510
Windham High Peak 3534
Ontiora 3458
Roxbury
W. Jewett Mt. 3025
Black Head 3945
Cairo
Cairo Round Top
Athens
Hudson City
Black Dome 4002
Catskill
North Mt.
Catskill Station
Hunter 1609
Hunter Mt. 4038
Big W. Kill 3896
Shandaken 1069
High Peak 3664
Saugerties
Phoenicia 790
Overlook Mt. 3150
Tivoli
Graham Mt. 3886
Panther Mt. 3828
Mt. Pleasant
Barrytown
Slide Mt. 4205
Shokan
W. Hurley
Kingston
Peak o' Moose 3875
High Point 3098
Hurley
Rondout
Rhinebeck
Rhinecliff
Hussey Hill
Hudson River
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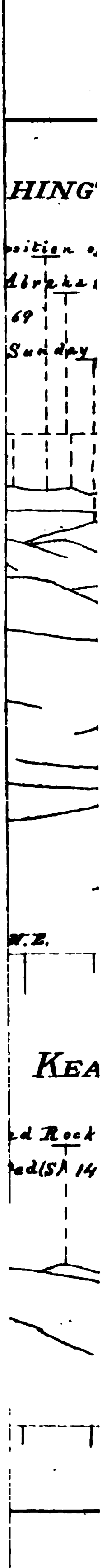
SECTION ACROSS THE REGION OF PLATEAUS
Summit
Schoharie Cr.
HELDERBERG
Albany
Normans Kill
SECTION ACROSS THE MOUNTAIN REGION
Peak o' Moose
Slide Mt.
Panther Mt.
Big West Kill
Esopus
Hunter Mt.
Schoh'e Cr.
E. Jewett Mt.
Black Dome
Windham High Peak
Catskill Cr.

E. Sandoz del.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APPALACHIA.

Vol. II. BOSTON, MAY, 1881. No. 3.

The Annual Address of the President.

By Charles R. Cross.

Read January 12, 1881.

In the midst of Paris, on the Rue de Rivoli, rises the Gothic tower of the old church of St. Jacques de la Boucherie. The only remnant of that ancient building, the rest of which was long since destroyed, it still stands, an exquisitely beautiful relic of four centuries ago. Its summit, crowned with the evangelistic symbols roughly carved in stone, is seen from a distance in every direction, and it is a landmark which attracts the notice of the most casual observer.

But beyond all its architectural beauty, the old tower has for us a far greater interest, because of him in whose memory it has been allowed to remain, and whose statue stands within its base. For it was here that, two hundred and thirty-three years ago, in 1647, the renowned Pascal first performed an experiment which will never be forgotten in the history of science.

It is hard for us of this nineteenth century to realize the condition of physical science at that time. It was but fifty-seven years since Galileo had finally disproved the Aristotelian dictum, that bodies acquire velocities in falling proportional to their weight, by dropping two balls of very different masses from the Leaning Tower at Pisa, and so proved these principles which Newton, long after the date of Pascal's research, formulated as the First and Second Laws of Motion. But the

minds of even professed scholars were still in the greatest state of confusion as to physical principles. "Arriaga," says Whewell, "who wrote in 1639, is troubled to discover how several flat weights lying one upon another on a board should produce a greater pressure than the lowest one alone produces, since that alone touches the board," but suggests that the board affects the upper weight, though not touching it, by determining its *ubication*, or *whereness*. Cardan also puzzles himself because, "if one man can draw one-half of a certain weight, and another man also one-half; when the two act together these proportions should be compounded, so that they ought to be able to draw one-half of one-half, or one-fourth only!" to which Whewell adds, "The talent which ingenious men had for getting into such perplexities was certainly at one time very great."

It was then only twenty-five years since Kepler's "Epitomæ" had appeared, and the planets been found not to revolve in the circle, the perfect curve; and forty years before Newton, by his demonstration of the gravitation of the moon to the earth, finally showed that bodies celestial and terrestrial alike are governed by the same all-embracing laws.

About five years before the date of Pascal's experiment it had been found by the pump-builders of Tuscany that "Nature does not abhor a vacuum above thirty-four feet," as Galileo sarcastically explained the cause of their difficulty; and Torricelli had proved experimentally by constructing the first barometer, what had before been asserted, that the atmosphere, so far from being gifted with a characteristic levity, on the contrary, possessed a definite and considerable weight, and that to the pressure thus caused Nature owed her apparent horror of a vacuum. Here it was that Pascal took up the matter. Spirits, it was said, rising from the mercury or the water, caused the depression of the mercury in the barometer-tube, and the refusal of the water to mount higher in the pump. To disprove this view, Pascal erected in the public squares of Rouen huge barometers containing water, oil, and wine, and found that these liquids which exhaled "spirits," so called, to a far greater degree than mercury, yet rose to a greater height, in proportion to their lesser densities. His

opponents not being convinced, even if silenced, — or perhaps unchanged in their opinions, because convinced against their wills, — Pascal studied to devise yet another and crucial experiment. And so he reasoned, that if the atmospheric pressure were to be diminished in any way, the height of the mercurial column should also diminish in like manner. The air-pump, with which we should now so easily make the experiment, was not invented till three years after this date, so that Pascal imagined the far more beautiful method of repeating the experiment of Torricelli at some elevated place, and noting the result. This reasoning is so interesting, that I will read one or two paragraphs that I have translated from his work on the "Equilibrium of Liquids and the Mass and Weight of the Air" (pp. 168, 171–172): —

"I am now at work," he says in a letter, "in examining the truth of the former (proposition); viz., that Nature abhors a vacuum, and seeking for experiments which shall show whether the effects that are attributed to the horror of a vacuum ought in reality to be attributed to this, or whether they should be attributed to the weight and pressure of the atmosphere; for, to open my mind to you frankly, I can hardly believe that Nature, which is in no way animated or sensible, can be susceptible of horror, since passions presuppose a soul capable of feeling them; and I incline rather to impute all these effects to the weight and pressure of the air; because I consider them as particular cases of a general law of the equilibrium of liquids."

Then, after a few remarks, in which he defends his general views as to the giving up of old maxims, and mentions a familiar experiment, he continues: "I have invented one (experiment) which will of itself suffice to give us the light sought for, if it can be executed with exactness. It is to make the ordinary experiment of the vacuum (Torricellian experiment) several times in the same day, in the same tube, with the same quicksilver, sometimes at the top and sometimes at the base of a mountain, elevated by at least 500 or 600 toises; to find if the height of the quicksilver sustained in the tube will be the same or different in the two cases. You doubtless see already that this experiment will be decisive, and that if it

happens that the height of the quicksilver is less at the top than at the base of the mountain (as I have many reasons for believing that it will be, even if all those who have meditated upon the matter were of a contrary opinion), it will necessarily follow that the weight and pressure of the atmosphere are the sole causes of this suspension of the quicksilver, and not the horror of a vacuum, since it is very certain that there is more air which presses on the foot of the mountain than on its summit, though we can hardly say that Nature abhors a vacuum at the foot of the mountain more than at its top."

These paragraphs occur in a letter to his brother-in-law, Périer, who aided Pascal in carrying out his plan. But the first experiment was made at the Tower of St. Jacques by Pascal himself, and here, after reading the height of the mercurial column at its base, he slowly climbed the steps of the tower, till at the summit he had the gratification of seeing the mercury stand at a level one-sixth of an inch lower than it had stood in the street below. Then, to render the proof complete, Pascal wrote to Périer the letter from which I have quoted, and requested him to repeat the experiment on the Puy de Dome in Auvergne. This Périer did, finding a fall of 2 inches when half-way up, and $2\frac{9}{12}$ inches when at the top of the mountain.

But although Pascal, and apparently also Descartes, saw the possibility of an estimation of the elevation of a station from the observed depression of the barometrical column, yet the data for even an approximate formula for such a determination were entirely wanting. The most essential element in any such determination is a knowledge of the law connecting the changes in density, when air is compressed or rarefied, with the varying tension; and beyond the mere fact that the tension increases or diminishes with increase or diminution of density, nothing definite was known until, twenty years after the experiment of Pascal, the approximate law connecting these two variables was demonstrated independently by Boyle in England (1679) and Mariotte in Paris. The last-named observer first propounded an approximate formula for the barometric determination of altitudes, and also in 1676 constructed a table based upon observations made at the

Observatory of Paris. The values obtained were, however, quite erroneous, and this work of Mariotte would be forgotten were it not for its connection with the researches which resulted in the discovery of the law which in all French-speaking countries still bears his name.

It was reserved for the English astronomer, Edmund Halley, to deduce the simple law connecting the diminution of tension of the air (which tension is, of course, measured directly with the barometer) with the elevation at which the instrument stands; and he first, by a very simple demonstration, showed that the difference of elevation between two stations, in toises, is represented by the formula

$$h = 9719 \log \frac{B'}{b'},$$

in which B' and b' are the heights of the barometer in lines, or in English measure,

$$h = 62169.795 \log \frac{P}{p},$$

P and p being expressed in inches.

Halley calculated his constants on theoretical grounds, according to the most accurate data that he possessed, from the known relation between the specific gravity of air at the normal pressure and temperature, and that of mercury also at the normal temperature.

But it will be seen upon the slightest consideration that even in this form the formula is quite incomplete.

In fact, the heights of the barometer as read will give an approximate difference of elevation for the stations, which, upon the assumptions made in calculating the formula, would be correct if the temperature of the mercury in the barometer were 0° C. at each station, the temperature of the air 0° C. at each station, if the effect of capillarity in giving a convex surface to the mercurial column were negligible, if the latitude of the stations were 50° or thereabouts, and the force of gravity invariable between the upper and lower stations. In no case can all of these circumstances be realized. But these points do not seem to have been considered by Halley.

Succeeding observers considered them more or less fully. Among these, Tobias Mayer constructed a table based upon Halley's formula, and Fontana first applied the corrections

mentioned by Newton years before (1686), on account of the diminution of gravity as we ascend above the surface of the earth. Deluc about 1765 first investigated two other and more important corrections, — those for the temperature of the mercury of the barometer and for the temperature of the air. Evidently, if the temperature is less at the upper than at the lower station, a part of the diminished height of the barometric column at the upper station will be due to the increased density of the mercury caused by its lower temperature. Hence we must in our calculations take this into account. Also the temperature of the air at the two stations not being 0° C. and further, the temperatures at the two stations being in general different, a correction must be applied for this, and a certain mean temperature assumed as that of the column of air extending between the two stations. The value of these corrections Deluc determined experimentally; and as he also used incorrect values for the respective coefficients of expansion of air and of mercury, the corrections were quite erroneous. It was a very important step, however, to recognize the necessity for these corrections. The formula of Deluc has also a certain historical interest, as it was by its use that De Saussure determined the heights of Mont Blanc in 1787 and the Col du Géant in 1788. Successive improvements, chiefly in the determination of the mean air-temperature, were proposed by Hennert in 1785 and others. Fontana's work has already been mentioned. Kramp showed the necessity of a correction depending upon the latitude, and many of these corrections were combined by Playfair in his formula.

Such was the state of science when the question was discussed by Laplace, who, in the fourth volume of the "Mécanique Céleste," gives a formula which takes into account all those circumstances which in his time were known to cause variations in the height of the barometer, and whose laws were sufficiently well known to allow of their incorporation into a formula.

The formula as given in the fourth volume of Bowditch's translation of Laplace stands in the following form, the same

in which it is given in Delcros's tables in Guyot's collection of tables, with the exception of a slight change in the coefficient of the term for the correction of latitude: —

$$Z = 18{,}336 \times \left\{ \begin{array}{l} \left[1 + \frac{2(t+t')}{1000}\right] \\ \left[1 + 0.002845 \cos 2L\right] \\ \left[\left(1 + \frac{z}{a}\right) \log\left(\frac{h}{H}\right) + \frac{z}{a} 0.86589\right] \end{array} \right\}$$

This not being in a form convenient for computation, Oltmanns transformed and simplified it so as to read

$$Z = \log\left(\frac{h}{H}\right) \times 18{,}336 \times \left\{ \begin{array}{l} \left[1 + \frac{2(t+t')}{1000}\right] \\ \left[1 + .0028371 \cos 2L\right] \\ \left[1 + \frac{z + 15926}{6{,}366{,}200}\right] \end{array} \right\}$$

Here the heights of the barometric column at the upper and lower stations, H and h, are in millimeters, t and t', the temperatures of the air at the stations, in Centigrade degrees, and the approximate elevation, Z, in meters. L is the latitude of the place at which the experiments are made.

From this formula the tables of Delcros in metric, and those of Guyot in English measures are deduced.

It will be seen that this formula is of the form

$$Z = \log\left(\frac{h'}{H'}\right) \times 18{,}336 \times [1 + A + B + C],$$

in which the approximate value $Z = \log\left(\frac{h'}{H'}\right) \times 18{,}336$ is obtained by considering the observed heights of the barometer corrected only for capillarity and the temperature of the mercury. The result thus obtained is then successively corrected for the variation in temperature of the air (A), and for the variation of gravity with latitude (B) and with height (C).

As the formula of Laplace is the basis of many of the tables at present in common use, especially of those of Guyot, it will be interesting to consider its various terms successively, and ascertain what elements of uncertainty, if any, exist in them. In this we shall find our labors materially lightened by the discussion given by Williamson in his valuable work

upon the barometer, to which I shall have frequent occasion to refer.

Such a study of the various terms of the formula is a necessary preliminary to the consideration of other variable elements in the accurate determination of altitudes by the barometer; for it is well known to all who have used that instrument practically, that such close results as those quoted by Guyot in the preface to his tables are to a very large extent accidental, and it is my object in the present address to point out certain facts, which, although well known to meteorologists, have yet too often escaped the notice of amateur, and even of professional, observers.

Regarding the two preliminary corrections, those for capillarity and reduction to the freezing-point, there need be no error of any considerable magnitude. The relation of the coefficients of expansion of mercury and brass is perfectly well-determined, and is used in modern tables. As to capillarity, the corrections, though empirical, are easily ascertained from the tables constructed for the purpose, and given in all standard collections of hypsometrical tables. To make use of them, the interior diameter of the tube must, of course, be ascertained with accuracy, and should be found by the maker of the barometer in the course of its manufacture. The height of the meniscus is different in boiled and unboiled tubes, and it is quite possible that with modern barometers filled by Green's process, in which the air is exhausted by a pump, and the mercury then allowed to enter, the corrections may be different from those indicated by tables prepared for barometers in which the air has been expelled by boiling the mercury. Also, with a siphon barometer the correction for capillarity is slightly different for the end of the tube which is exposed to the air from that for the closed end, so that this form does not furnish that perfect correction for capillarity designed by its inventor. The error is very slight, however. There is also a very slight variation in the correction for capillarity, according to the direction of the motion of the mercurial column; but if the mercury is clean, this is not of sufficient magnitude to need consideration in the present state of barometric hypsometry. If the mercury is at all oxidized or

otherwise foul, or if the tube is dirty, there is, of course, a very considerable liability to error in this correction. Such fouling of the mercury or the tube, however, calls for cleaning and refilling before the barometer is in a fit state for accurate measurements. There is also, perhaps, a possibility of deviation from the tabulated results, caused by differences in the glass of which the tube is made.

We have next to consider the value of the constant, 18,366, by which the difference of the logarithms of the corrected barometric heights must be multiplied to obtain the uncorrected difference of elevation between the two stations. This coefficient, as originally deduced by Laplace, was 18,317, which was the value resulting from a comparison of the densities of air and mercury. The values used were those found by Biot and Arago, for the relative density of mercury and air (1 : 10,467). Also, in calculating the correction for the temperature of the air (A), Laplace took Gay Lussac's value for the coefficient of expansion (.00375), but finally concluded to use the coefficient .004 instead, in order to allow for the greater expansibility of the water-vapor present in the atmosphere; not considering this separately, as has been done by other and later physicists. This computed value of the constant 18,317 we now know to be considerably in error, even on theoretical grounds, as the later observations of Regnault and others have shown large deviations from exactness to exist in the results of the earlier experimenters. Still greater errors have been found in the coefficient of expansion assigned to dry air by Gay Lussac; but if no separate correction is to be made for the amount of water-vapor present in the atmosphere, the value assumed by Laplace as a mean coefficient of expansion for moist air is as favorable a number as has been proposed. The number originally deduced, however, *i. e.* 18,317, was corrected by Laplace, so as to cause the results calculated by the formula to agree with the results of direct trigonometrical measurements; a subject upon which Ramond, at the time of the publication of the formula, made a long series of investigations. I do not know whether the number 18,317 was used in the earliest edition of the "Mécanique Céleste," but in those editions which I have seen the other number, 18,336, is used without exception.

Williamson remarks that he has not been able to ascertain the character of the results of Ramond, but suggests that, if they were made chiefly during the summer months, the value of the constant is probably too small, for reasons that we shall see a little farther on in our investigations. I have not seen Ramond's work, but I find in the bibliographical table in Rühlmann's Memoir, published since Williamson wrote, that Ramond's "Mémoire sur la Formule Barométrique de la Mécanique Céleste" was published in Paris in 1808–11. Rühlmann gives a brief statement to the effect that Ramond, from noting discrepancies between results calculated by Laplace's formula and those obtained by levelling and trigonometrical measures, was led to undertake a careful series of measurements on the Pic du Midi de Bigorre. Williamson naturally suspected that the measurements were made in the warmer months. They were, in fact, mostly made late in September, 1803, so that the remark of Williamson as to an error on account of the season is not so applicable as if they had been made in summer, though it is to a certain extent true. Rühlmann also states that Ramond found that Laplace's constant, 18,336, should be changed to 18,393. From this I infer that this was a later change, suggested to Ramond by larger observation.[1]

From these statements we see that Laplace's constant is an empirical one, and that any abnormal circumstances peculiar to the local climatic or other conditions, or to the hours or season at which the observations in question were made, will tend to cause errors in the general result in cases of elevations determined by means of the formula.

Plantamour, using a formula which had previously been proposed by Bessel, modified the coefficient by substituting for the older values of the specific gravity of air and mercury, which had been used by Bessel, the far more accurate values obtained by Regnault. The coefficient thus modified becomes 18,404.8, and there is no doubt that this is a better value to make use of than that given by Laplace. Bauernfeind uses

[1] Since writing the above I have found from Ramond's Memoirs that the first constant used by Laplace was 17,972.1 m., which was finally increased by Ramond to 18,393 m.

what is practically the same coefficient, viz. 18,404.9, while Rühlmann, in the latest and most complete formula yet published, uses the value 18,400.2. The long series of observations in Switzerland, by Plantamour, as quoted by Williamson, give a difference of level between Geneva and the Great St. Bernard, which is 47 feet less than the real value as found by the level if the formula of Laplace be used, and 9 feet less if that of Plantamour be applied. Williamson concludes from the observations at his disposal, that observations in midsummer, not corrected for the monthly variations of the barometer, will probably give more accurate results by Laplace's than by Plantamour's formula. The reason for this is quite clear when we consider the way in which Laplace's constant was finally determined. It will be seen, however, that there is still room for much investigation upon this point among our own mountains.

Regarding the correction for latitude (B) little need be said. It is very slight, in our latitude amounting to but 1.6 feet for a mountain 6,000 feet high. Hence any error in this portion of the formula would cause a negligible error in the final result. As a matter of fact, the coefficient given in Bowditch's Laplace is .002845 cos 2 L, that in Guyot's Delcros's tables is .00260 cos 2 L, Plantamour gives .002636 cos 2 L, Bessel .002657 cos 2 L, and Rühlmann .00262 cos 2 L; these slight differences being of little practical importance.

The remarks just made apply with equal force to the small correction for the decrease of gravity acting upon the density of the mercury of the barometer, and on the density of the air (C). In fact, it would be difficult to devise a general and extremely accurate formula for this last, inasmuch as the disturbing effects of the mountains upon which measurements are made require the use of an empirical formula, which must be more or less variable according to the locality. Rühlmann suggests a term considering the effect of such local disturbances, but it is of no real use.

There remains the consideration of the correction for temperature of the air (A), the most important of all, and that regarding which there is by far the most doubt. Since the temperatures at the upper and lower stations are generally

different, it is necessary to find some way of avoiding the difficulty thus arising. The most accurate way would, of course, be to multiply stations, and then, whatever law of change of temperature with altitude we might assume, the liability to error would be greatly reduced. This multiplication of stations is, however, generally impracticable, and hence we must assume some law of change of temperature. The supposition most generally made is that originally used by Deluc, that the mean temperature, equal to half the sum of the temperatures of the two stations, can be taken as the assumed value by which to calculate the expansion of the air. This supposition is well known to be incorrect, and various more or less complicated modifications of it have been proposed by Bäyer, Ritter, and others, based upon certain suppositions regarding the law of change of temperature with altitude ; but none of them are at all satisfactory. In fact, the variations of temperature as we ascend are, as Glaisher has shown by his balloon observations and otherwise, exceedingly irregular.

Under these circumstances it will be seen that there is a very considerable error liable to be introduced into our results from a want of knowledge of the true mean temperature of the air. It would be interesting if a series of measurements could be made in the night-time, to ascertain whether with the greater quiet and homogeneity of the air at that time more reliable results could be obtained.

In what I have said, I have supposed the temperature of the air itself at the two stations to be well known. But here there is a liability to an error of at least two or three degrees, which would involve a noticeable error in the temperature correction. In many cases where single observations and not a series are made, not enough care is taken in this regard. The thermometer should, of course, be carefully protected from radiation from houses, rocks, or the person of the observer. The process of swinging it in the air has doubtless a certain value. An interesting series of experiments could be made by comparing the values obtained for the temperature of the air by this method with the more accurate values of the same temperatures, as determined, for example, by the beautiful method suggested by Joule.

This is also the proper place to consider the question of a separate correction for the tension of aqueous vapor present in the atmosphere. Of course, this tension must be taken into account in any consideration of the barometric determination of altitudes, since the elevation of the barometric column depends, in part, upon the amount of aqueous vapor present in the atmosphere, as well as upon the tension of the air itself. But it has always been a question whether in the present state of the science it is well to attempt a separate correction for this. Laplace, as we have seen, gave an increased value to the coefficient of expansion in order to allow for the effect of the water-vapor, and it has been quite customary to correct in this way. This process has been followed by Laplace, Bäyer, and others, and is adopted in the tables of Delcros and Guyot. Soldner, in 1809, first adopted a separate correction for the tension of the aqueous vapor in the atmosphere, and many later observers, among them Bessel, Plantamour, Ritter, Bauernfeind, and Rühlmann do the same. It is a fact, however, that the indications of the ordinary wet and dry bulb hygrometer are quite local; and, as Williamson has so clearly shown, hygrometers, even when quite near each other, may give results differing considerably among themselves. Still more, as shown by Glaisher in his balloon ascents, and by Williamson from his observations in California, the law of change of vapor-tension with altitude is not at all known, if, indeed, any approximately constant relation exists even under favorable circumstances, so that the results given by the hygrometer are purely local. It would seem that, while in long-continued observations a separate correction for tension of water-vapor may be of value, for short series or single observations it is really of no use, and is sometimes harmful.

And now, before leaving this portion of my subject, a few words may be spoken relative to the tables which we may best use in calculating our results.

In the light of our present knowledge, I think that, making our observations in summer, which is, of course, generally the case with members of the Club, the admirably arranged tables of Guyot, published by the Smithsonian Institution, are

probably not only the most accessible, but also as accurate as any that can be used. For general, prolonged work, however, I am inclined to prefer those of Williamson, because they are based upon Plantamour's formula, which uses the constants as determined by Regnault, instead of the values assigned to them by earlier experimenters. The tables of Williamson also furnish the means of applying the corrections for aqueous vapor separately, if desired, when this is known from the mean of long-continued observations. A very short and compact table for ordinary use is that devised by Loomis, and given in Guyot's collection. An excellent set of tables is also given by Rühlmann in his work on barometric hypsometry; but these are not very accessible.

It will be seen that there is here an excellent opportunity for some members of the Club to render important aid to science. It would be very interesting to compute the height of Mt. Washington, for example, by means of the various formulæ, using the tables based upon them, at different hours of the day and at different seasons of the year, and to compare the results. The original observations taken at the signal-office at Mt. Washington could be obtained for the purpose, and these could be compared with the simultaneous observations taken at Portland. I shall have occasion shortly to present to you a few results of this kind, which, although less extensive than I could wish, are as full as I could make them with the scanty data at my disposal, and in the limited time at my command.

With a formula constructed upon the most accurate data, and embodying the various corrections already discussed, most observers have been content, and the great majority of our measurements of altitude by barometric observations have not attempted any further refinements of correction.

Nevertheless, as has long been known, there remain still certain considerable sources of error, some of which are much greater than the minor corrections which have entered into our formulæ. In the minds of most persons, it is thought that if simultaneous readings are made at the base and summit of a mountain, and the various corrections already discussed are carefully applied, a result of the utmost accuracy

attainable with the barometer can be reached. We have now to consider, therefore, the existence of various additional perturbations which cannot readily be considered in a formula, and which must still be taken into account if we desire to realize the best possible results with our method.

The irregular variations of the barometer at any station from day to day, or hour to hour, on account of various meteorological changes, such as the progress of storms and like causes, have been observed from very early periods, and no observer of the slightest experience would forget that if observations are made first at the base, and later, after an ascent, at the summit of a mountain, there is a great liability to error on account of this abnormal variation. On certain days the variation will be great, and at other times slight. If the observer returns at the end of the day to the station from which he started, he can detect the existence of abnormal changes, and if these are not too great, make an approximate correction for them. If the observations at the top and bottom of the mountain are simultaneous, it has generally been thought that any abnormal variation would affect each station equally, and hence cause no error. I think that when the horizontal distance between the two stations is only a few miles, — four or five miles, for example, — the assumption will lead to little or no error, though I should like an opportunity of making and comparing a series of observations taken in this way during the progress of a storm. If, however, the stations are at a distance from each other of say from twenty to forty miles, considerable errors may be introduced by the change at one station preceding that at the other. Kämz remarks, regarding this point, that it seems very probable that the abnormal variations diminish in amount as the altitude increases, which would, of course, affect all measurements made when such variations were in progress.

Besides these well-known abnormal changes, there are others which have been observed since the latter part of the last century. In the trigonometrical and barometric comparisons of Ramond (in 1806), already referred to, that observer noted that the time of day and position of stations, as

well as the weather, had an important influence on the measured height. He found that measurements made in the day gave a greater value for the elevation of the upper station than those made in the night; that north winds gave too great, and south winds too small, a height; and he constructed a table showing the effect of the time of day upon the measurements. Similar observations were made by De Saussure upon the Col du Géant. In a result cited by Rühlmann there is a difference of about three and a half per cent between measurements made at 7 A.M. and at noon, the total height being 251 metres. Ramond, while alluding to the influence of hygrometric state and temperature, refers the larger part of these differences to the effect of air-currents caused by varying temperature. He also shows that on isolated peaks the barometer is far more valuable than in determining small elevations in level countries. Still later, in 1808, Ramond published a brief sketch of some observations on the effect of the season of the year at which measurements were made, upon the elevations deduced, and found that, though the variations were somewhat irregular, the mean of the observations in spring and summer was greater than in the fall and winter.

The existence of a diurnal barometric variation thus indicated by Ramond was fully confirmed by succeeding observers, — D'Aubuisson, at Geneva and the Great St. Bernard (1818–21), and Horner, at Zurich and the Rigi (1837). The latter observer indicates the principle that should guide us in observations of this kind, by pointing out the necessity of a horary correction. The results of D'Aubuisson and Horner were confirmed by those of Kämz, in 1832. The existence and amount of the horary variations of the barometer have in later times been carefully studied by Bäyer, Plantamour, Renny, Bauernfeind, and Rühlmann, in Germany and Switzerland; the Von Schlagintweits, in India; and Bache, Guyot, Williamson, Whitney, and others, in our own country. A detailed sketch of the results reached by the foreign observers will be found in the monograph of Rühlmann, to which I am much indebted for the facts cited, entitled "Die Barometrischen Höhenmessungen," and published at Leipzig, in 1870, and also in English in Professor Whitney's "Contri-

butions to Barometric Hypsometry," published by the State of California. The limits of this address require me to pass over many of these with a mere mention, and to proceed to a consideration of the latest conclusions, especially those drawn from observations in our own country.

It is not necessary that I should in this sketch discuss the origin and physical nature of the periodical variations of the barometer which have been detected, except so far as is necessary to understand their relations to the barometric determination of heights. There are, however, many points upon which extended observations would be of value. If, for example, observers among the mountains could study the change in the height of the barometer for each hour of the day, and also of the night, and were the same done by other observers at the seashore, much valuable information as to the relation of these changes at different points might be accumulated.

The latest series of extensive observations in Europe, so far as I know, are those of Rühlmann, already mentioned; and as his monograph was written after a full investigation of all that had been done before his time, I think that I shall be justified in stating in full the chief results that he has reached, passing over those of the various earlier workers. These results, which may be regarded as clearly made out, are given in the fourth chapter of the work already cited, and are comprehended in four principal propositions.

I. The heights calculated from barometric and thermometric observations during the day are in general considerably greater than those calculated from observations made at night. They present an important daily period.

From the means of various observations made at Geneva and the Great St. Bernard during six years, Rühlmann draws the following conclusions: —

The heights as determined by the barometer are at a maximum a little before the time at which the temperature reaches its maximum; that is, at about one o'clock P.M. They then fall rapidly during the afternoon, more slowly during the night, and reach their smallest value about one or two hours before sunrise. From this minimum they rise very rapidly to a maximum about mid-day.

A small relative maximum, about two and one-half hours before the minimum occasionally appears; but its universality is not proved.

The daily period appears clearly marked only on days when, on account of a cloudless sky, a free radiation occurs, from the sun to the earth by day, and from the earth into space at night.

On cloudy and windy days the amplitude of the daily variation is greatly diminished, but without entirely disappearing.

The magnitude of the daily period is also dependent on the season and on local conditions. These become very marked if the absorptive and radiating power of the soil is great, and its capacity for heat small.

These normal changes may be obliterated by abnormal disturbing elements, for only a short time.

Rühlmann then gives à quite complex formula by which the normal daily changes can be represented.

II. The heights calculated by the use of the daily and monthly means of the barometer and thermometer show a yearly period. These heights are too small in winter and too great in summer. The amplitude of the yearly period is smaller than that of the daily period.

The character of the daily period is somewhat different in the different months, on account of the differing character of the seasons.

III. The heights given by the use of the yearly meteorological means differ but very little from the actual heights.

IV. The periodical variations in the heights determined by the barometric method, both daily and yearly, can be divided into two parts, of which the first, which is much the larger, arises from the variation in temperature; and the second and smaller, from the variation in the actual barometric height. These two periods have in general opposite signs.

Rühlmann also draws from his investigations some interesting conclusions regarding the temperature of the air, which I could not well mention in the earlier part of my sketch of the history of this subject, as they are so intimately connected with the question that is now under consideration. He finds the true mean air-temperature by considering this to be the

unknown quantity in the barometric formula, the actual difference of elevation between the two stations being known, and solves relatively to it. Comparing this with the arithmetical mean of the temperatures observed at the stations themselves, he finds the following facts to be true: The true temperature of the air during the time of a single period of variation changes neither so much nor so quickly as would be indicated by taking the arithmetical means of the readings of the thermometers at the upper and lower stations. The atmosphere, as a whole, does not become warmed so rapidly, nor to the extent indicated by the thermometers. The atmosphere, as a whole, partakes only slightly of the daily changes, and to a very diminished extent of the annual variations of temperature. Both with the daily and yearly periods the extremes of the temperatures of the atmosphere are really retarded, when compared with the extremes of the indications of the thermometer. Also, the thermometric readings give a result higher than the real temperature of the atmosphere. Finally, the two periodic variations in the barometric heights lead to the conclusion that a false temperature is ascribed to the column of air producing the pressure (and which serves as a basis of computation), if the arithmetical mean of the observed temperatures at the upper and lower stations, or any simple function of the same, is taken.

These conclusions of Rühlmann are justified by the numerical results given in a series of tables, which results are also represented graphically in an interesting set of curves.

He also gives a table showing at what hours of the day in each month the best results may be expected from barometric measurements. They are as follows: —

1. December is to be avoided entirely.

2.	January,	12 M.
3.	February,	4 P.M. and 10 A.M.
4.	March,	6 P.M. and 8 A.M.
5.	April,	7 P.M. and 7½ A.M.
6.	May,	7 P.M. and 7 A.M.
7.	June,	9½ P.M. and 6½ A.M.
8.	July,	9½ P.M. and 6½ A.M.
9.	August,	7½ P.M. and 7 A.M.
10.	September,	6 P.M. and 8 A.M.
11.	October,	3½ P.M. and 10 A.M.
12.	November,	2½ P.M. and 10½ A.M.

These numbers are derived from the monthly means, and are especially adapted to the middle of the month. Rühlmann does not, however, give any table by which to correct observations taken at other hours than those indicated, thus leaving a gap in his valuable and remarkably complete work.

There is a table, however, at the end of his work by which a closer approximation to the true mean temperature of the atmospheric column between the two stations can be found than by simply taking the arithmetical mean of the thermometer readings at the two stations; the argument being the half-sum of the temperatures observed, and the correction for each mètre of height being assumed as equal to this sum multiplied by the constant 0.183. This supposes that a separate correction for moisture is to be applied.

Before leaving my sketch of Rühlmann's results, I may say that his work contains by far the fullest bibliographical list of works relating to the barometer that has come under my notice.

The results thus far considered have been obtained in Europe, where, of course, meteorological studies have been prosecuted longer, and, till the establishment of our United States Signal Service, to a far greater extent than in this country, though the earlier observations carried on here under the guidance of the Smithsonian Institution and at the station at Toronto ought not to be forgotten. In work of this nature it is to be expected that varieties of climate, of latitude, of soil, and other circumstances, may cause considerable modification of general laws. It is therefore a matter of great interest to know what conditions obtain in our own country, and to what extent the conclusions of European observers can be applied to the different parts of our own territory.

The great general features might justly be assumed to be the same, and the general laws of the daily and yearly variations have for some time been known. As we shall see, however, very much remains to be done. Let us, then, briefly review some of the work that has been done in this country.

In the invaluable collection of tables by Professor Guyot,

published by the Smithsonian Institution, the existence of daily, annual, and other variations is clearly recognized, and a long series of tables is given, by which corrections for these variations may be applied, the tables being the best then constructed; and, indeed, so far as the eastern portion of North America is concerned, they are still as full as any that are accessible. Yet the necessity of applying such corrections to measurements of altitudes is not enforced, nor is any such correction applied in the examples given of the determination of the height of Mont Blanc, Mt. Washington, or Black Mountain in North Carolina.

Passing over several detached articles in the United States Coast Survey reports and in the Pacific Railroad reports, we come to the work of Williamson, published in 1868, two years before the appearance of Rühlmann's work. Colonel Williamson worked under the great disadvantage of inability to consult any large collection of works upon the subject of his researches, which renders his in every way excellent volume still more worthy of praise.

Of his various investigations I shall mention only those points which will aid us in understanding the lines of investigation which can be profitably and readily pursued in order to advance our knowledge of barometric hypsometry.

The first point of this kind is the manner suggested for finding the horary variation and curve for any place from a comparatively brief period of observation. The ordinary, and of course the best, method of determining the amount and character of such variations is to determine the mean height of the barometer at any place, from a series of observations taken at different hours and extending through several years, and to compare this with the mean of the heights at particular hours of the day and in particular months. This method is evidently impracticable except for permanent stations. Williamson shows, however, that except when the abnormal variation due to changes in the weather, such as the progress of storms, etc., are very great, by observations for a few days quite a good knowledge of the daily variation, for the season at which the observations were made, can be obtained.

His method consists essentially in assuming the amount of the abnormal variation for different hours to be proportional to the time elapsing from the beginning of the observations. Hence, if these are taken hourly for twenty-four hours, the rise or fall of the barometer during the day can be found, thus giving the abnormal variation in a single day. We can compute from this, upon the assumption mentioned of a steady rate of change, the variation in height at each succeeding hour due to the abnormal variation, and by subtracting this algebraically from the total observed change up to the hour considered, the periodic horary variation may be found. The assumption of regularity in the abnormal change of height of the barometric column may sometimes be false; but if the observations of several different days give similar results, — which can readily be noticed if these are represented graphically, — and if the daily amount of abnormal variation is approximately the same for successive whole days, the assumption can be accepted as practically true. If this does not turn out to be the case, the method, of course, becomes inapplicable. Williamson's results, however, show that with the climatic conditions of California the method is an accurate one, and there is no doubt that unless the changes are exceptionally violent, as in case of sudden local storms, the methods can be applied in any locality. The curves given by Williamson show very beautifully the characteristic double maximum and minimum which are shown to exist by taking the means of long-continued observations, and also the variation in the horary curve according to the seasons. The case of irregular abnormal variations is discussed in full by Colonel Williamson, who concludes that the curves drawn from observations made as described are in many respects more characteristic than when made in the usual manner, unless very long series are used, and the means for each different month taken. That the method is not merely a special one, applicable to places of peculiar climate, is shown by giving curves of observations at different places, as San Francisco, Astoria [Oregon], and Fort Yuma on the Colorado River. It is also shown that the results of this method, when compared with those derived from the mean of

long-continued observations, are very satisfactory. Tables are given showing the horary variation at a number of western stations, as well as at Toronto, Philadelphia, Geneva, and the Great St. Bernard.

Williamson next discusses the question of abnormal and monthly variations, gives a number of tables relating to these, and shows clearly that there is a necessity of applying a correction for the hourly and monthly periodic variations; the mode of applying this being indicated at length. The barometric height should first be reduced to the freezing-point; next, the correction for periodic variation should be applied, and then the other usual corrections. The conclusion is also reached that, "leaving out of consideration all errors resulting from imperfections in the instruments and carelessness in the observers, there will remain erratic results from daily means, due to the atmosphere not being in a state of dynamic equilibrium, and that these erratic results cannot, therefore, be controlled by any law that can be established, and hence they must be incident to all measurements of this kind."

"If there could be discovered," Williamson goes on to say, "in the results from daily means any method in the arrangement of the errors, by which a result greater or less than the mean corresponds to a high or low barometer or the reverse, we could then modify or amend the formula so as to make it more conformable to the facts as developed; but as no such correction is discovered, we have no evidence to show in this species of erratic results that the fault lies in the formula. We have thus far produced no evidence that the formula does not need modifying; but such evidence must be sought for in the results of long series, and not in the variations of those from monthly means."

Colonel Williamson then considers the results calculated from monthly means, using, as previously, the results of Plantamour in Switzerland, and those found by himself in various Western States. He obtains some very interesting results, among which are the following:—

In the consideration of the different reasons on account of which the results of observations in different months vary

among themselves, the following process is adopted: Values for the constant of the barometric formula and for the coefficient of expansion of air to be assumed in the temperature-correction are computed for different months, assuming the true difference of elevation of the stations to be known, and the value of the constants for Geneva and the Great St. Bernard, as deduced from Plantamour's observations, are given for different months in the year. It is found that while there is a considerable variation in the constants, every value is greater than that given by Laplace. In California the general results using the formula of Plantamour are about the same as by Laplace's, because the climate is quite dry; whereas in Switzerland the results by Plantamour's formula are greater than by the other.

The work of Williamson, then, clearly recognizes the need, and points out a way of applying corrections for the hour and season of the observation, which corrections had previously in this country been neglected in almost all determinations of heights by the barometer.

Lastly, we have to turn to the work of Professor Whitney of the Geological Survey of California, entitled "Contributions to Barometric Hypsometry," and published in 1874. This work contains an introductory sketch upon the general methods of barometric hypsometry, an account of the author's investigations in California, and a *résumé* of similar investigations in other places. This last chapter contains the fullest discussion of the various foreign observations of later date to be found in our own language, and there is nothing which the inquirer can read that will give him a better idea of the present state of the science than this excellent monograph.

At present, however, I must content myself with stating the results reached in California.

The importance of Whitney's work is manifest when we consider the truth of his remark, that although the existence of the various periodic changes had long been known at the date of his investigations, yet no systematic attempt had ever been made to eliminate the errors thus caused in the barometric determination of altitudes. In this Professor Whitney does not ignore the earlier work of Williamson, which

was yet, as we have seen, of necessity very limited in its scope.

It was the object of the California investigations to determine a table of corrections to be applied to observations at different seasons and different hours of the day. In order to study the problem, Professor Whitney selected three stations: Sacramento, Colfax, and Summit Station on the Central Pacific Railroad. The altitudes of these were known accurately from the surveys of the railroads, and the observations were continued for three years. At the two lower stations the observations were made with great regularity, and those at the Summit Station were made with very considerable regularity during that period.

The distance of the stations from each other, on a straight line, and the elevations, were as follows:—

	Distance.	Difference of Altitude.
Sacramento to Colfax	45 miles.	2,399 feet.
Colfax to Summit	36 "	4,590 "
Sacramento to Summit	77 "	6,989 "

The latitudes were: Sacramento, 38° 35′; Colfax, 39° 7′; Summit, 39° 20′. The observations were taken at the hours recommended by the Smithsonian Institution, 7 A.M., 2 P.M., 9 P.M. It was not considered necessary to adopt a more accurate method of obtaining the mean daily result, as hourly observations could not be taken on account of the limited means at command. In working up the results it was finally concluded to make use of Williamson's tables, which give altitudes about 4 feet in 100 higher than those of Guyot.

From the result of these observations, which extended from September, 1870, to October, 1873, Professor Whitney derives the following conclusions:—

I. The results are always lower at morning and night than at mid-day. To this rule there is no exception.

II. The results are lower in winter than in summer. This rule seems to be general, in spite of a few anomalous results.

III. Hence, as a general rule, the lower the temperature of the locality, the lower the barometric result, and *vice versa.*

IV. Altitudes determined from daily means approximate most closely to the truth in February, September, and Octo-

ber, between Sacramento and Colfax; that is to say, during the months of transition from one extreme season to the other. Between Sacramento and Summit the best results from daily means are obtained in the summer months, from June to August; while between Colfax and Summit the best daily means are to be expected in March, April, and September.

V. The mean of the day for points in the foot-hills is much too high during the summer, though not far from the truth in the winter; but for mountain localities, the station barometer being kept in the valleys in both cases, the summer season gives the best approximation, the results in winter being much too low.

VI. Mid-day observations give results which are greatly too high all the year round, in the valley and foot-hills. The excess sometimes amounts in summer to more than 100 feet, and seldom if ever falls below 25 feet between Sacramento and Colfax, whose true difference of level is only 2,400 feet.

VII. The 7 A.M. and 9 P.M. observations give results which agree in the main with each other. Both hours give results too low all the year round, almost without exception. . . . In winter the discrepancy between Sacramento and Summit was enormous, in the case of the 7 A.M. observations, amounting in one case to three and a half per cent of the total difference of altitude.

VIII. The mean of the year is a little too *high* between Sacramento and Colfax, too *low* between Sacramento and Summit, and quite near the truth between Colfax and Summit. This is probably due to the necessary position of the thermometers; at Summit, within a few feet of the ground, so that as the lowest stratum of air is cooled by the snow, the value of the thermometric readings is somewhat below the truth. At Colfax, on the other hand, where no snow falls, the contrary is the case.

A series of twenty-five tables is given embodying the results of the various observations. It is found that a period of three years is not enough, when observations are taken but three times a day, to eliminate all irregularities. Tables are calculated in which the most probable mean values of the errors

at different seasons and hours are shown, the most discrepant observations not being considered in their construction; and from these a number of interesting results are shown to follow, for which I must refer those interested to the original paper. Those tables which have the greatest practical value are numbered XXIII., XXIV., and XXV., and show the corrections to be made for each 1,000 feet difference of altitude at different hours of the day for each month of the year. The curious fact is developed, that the amount of the correction for 1,000 feet is different, according to the position of the stations, — a result probably depending upon the rate of diminution of temperature as we ascend.

Professor Whitney finally shows by a comparison of results that greatly increased accuracy is secured by the use of the tables referred to. Taking a very unfavorable example, the Yosemite Valley, for which the corrections determined are not well adapted, the maximum difference of results is reduced from 214.4 feet to 144.9 feet in a total elevation of about 4,000 feet. In a more favorable case, the altitude of a camp in Tuolumne Cañon, the extreme difference is reduced from 323.3 feet to 167.5 feet in about 7,800 feet. In the altitude of Peregoy's, the extreme difference is reduced from 96.1 feet to 13.1 feet in 7,000 feet. In all these cases single observations have been taken independently, and the variation of each from the mean determined. If the mean of two successive morning readings, for example, had been taken, the result would be still better. Thus in the case of Tuolumne Cañon the maximum difference is reduced from 251.1 feet to 91.0 feet, or sixty-four per cent.

The importance of such corrections, especially if the barometer is used in running trial lines in preliminary surveys, as was done in the case of the Pacific Railroad, is insisted upon most strongly; and it is concluded that by the use of these or similar tables of corrections the determinations of the barometer are rendered as accurate as is possible, except where stations can be maintained for a long period.

The results of Whitney are of course strictly applicable only to the region of the Sierra Nevada. When the results

of the geological survey of the Territories are fully published, tables for use in the Rocky Mountains and adjacent regions will result; but these will hardly be applicable to our Appalachian system, so that there is here a gap to be filled before the fullest use of the barometer can be made, even among those regions in which the special work of the Club chiefly lies. For this reason I wish to conclude this paper by a brief consideration of some of the directions in which our inquiries may most profitably be prosecuted. There is an ample field in which one may carry on work which will not only be an aid in the immediate determination of the heights of some of our Appalachian mountain peaks, but will also be a useful contribution to the science of hypsometry. It is in the hope that some among the members of the Club may feel disposed to aid in the work that I proceed to indicate in a few words some of the questions not yet fully answered.

First of all is the question of the best formula for general use. This can hardly be regarded as conclusively settled. If some person living, during the summer, in the vicinity of Mt. Washington, either at its base or at any point on the railroads, whose elevation is accurately known from levelling, would make a series of observations at the same hours at which the Signal Service observations are made at the station at the summit of Mt. Washington, and compare the simultaneous readings at the two stations, he would in a few weeks have some quite valuable data. With these he might ascertain which of the two general classes of formulæ, Laplace's or Plantamour's, gives the best result; whether there is any choice between them at particular hours; whether it is or is not best to make a separate correction for water-vapor; what are the relative heights found at different hours, morning, afternoon, and evening, according to the different formulæ. Also, by taking the known difference of altitude between the two stations, and using two different sets of observations, if the barometric constant and the mean temperature of the air between the two stations are made the unknown variables in the general formula, that value of the constant which gives the best result can be ascertained for different hours, for different months, and for the general mean. By a few days of

patient observation, the horary curves for any place might be calculated, and by comparing these with the horary variation upon the summit of Mt. Washington, one might ascertain how far the variations at the summit and at the lower station are synchronous, and also to what extent the abnormal variations are different at the two places. Some interesting data which would aid in the solution of this question will be found in the minute observations made at Mt. Washington, and published in the report of the Chief Signal Officer for 1873.

Another analogous research would be to determine how small a difference of elevations causes variation in the nature of the horary curve. Also, it is not yet settled whether the use of psychrometric readings may not be advisable when observations of stations quite distant from one another are compared, especially if the humidity is quite different; as, for example, if barometric readings at Mt. Washington were to be compared with similar ones taken at Portland.

There is a great amount of material which has been gathered by the United States Signal Service in the course of their observations, extending through so many years, upon the summit of Mt. Washington. But there are few stations near by among the mountains furnishing data to compare them with, and, moreover, the results obtained have never been published in full, nor worked up, so far as I am aware, in such a way as to give a final answer to these questions. So there is a fair field for amateur work.

It is always more pleasant, though far less easy, to show what results have been attained, than to merely point out the methods to be pursued in order to obtain them; and so it had been my earnest hope to be able to present you to-day with a series of results gathered from a study of the Signal Service observations. But, much to my regret, I am unable to bring such a series as I wished, for the reason that the published results most unfortunately do not (except in the last annual report) mention the original uncorrected readings of the barometer and thermometer at the various stations; which should, of course, be given in order to make them of any independent value to the student. In the annual report

of the Chief Signal Officer for each year are given the mean heights of the barometer for each month of the preceding year, reduced to the freezing-point and to sea-level; and also the monthly mean thermometer readings. It might seem, then, as it certainly did to myself when I began these investigations, that they would serve very well for such comparisons, even if not quite as satisfactory as the original unreduced readings would be. With this idea, it was my intention to construct a series of curves, for each month during the past six or eight years, and also the mean annual curve, or, better, the mean curve for six or eight years. This was to be done by comparing the reduced readings at Mt. Washington with those at Portland, Me.; and a curve was to be constructed with times for its abscissas, and the difference between the reduced readings at the two stations for its ordinates. The nature of such a curve would reveal the nature of the variations represented by it. But when it was too late to obtain the original records from the office at Washington, I found that this method was not perfectly applicable, for the reason that the reduction for elevated stations is not made by the formula used in the other cases, but that a *constant* correction, 6.36 inches, for Mt. Washington, is added to the observed readings. This constant is determined from Dippe's table, using as arguments the mean annual pressure and temperature. This, of course, rendered the method far less available than it seemed to be at first, and hence, after making a large number of computations, I felt obliged to relinquish the attempt to make an extended set of curves until some season when a longer time and more abundant leisure may enable me to procure the original records from Washington, in which case there is no doubt that some interesting results may be secured. By procuring the daily record, the diurnal variations can also be studied.

I have mentioned these facts before proceeding further, lest some one else should go over the very same ground, and perhaps fall into more or less serious error from ignorance of the correction applied to readings taken at elevated stations.

With the aid of the scanty data at my disposal, I have constructed a series of tables, to the consideration of which,

together with curves constructed from them, I ask your attention for a few moments.[1]

TABLE I.

REDUCED HEIGHTS OF BAROMETER.

1873–74.

1873.	Mt. Washington.	Portland.	Difference.
October . . .	30.070	29.982	0.098
November . . .	29.637	29.823	— 0.186
December . . .	29.815	30.022	— 0.107
1874.			
January . . .	29.815	30.064	— 0.149
February . . .	29.759	30.039	— 0.280
March	29.702	29.805	— 0.103
April	29.834	29.955	— 0.121
May	30.028	29.854	0.174
June	30.139	29.854	0.285
July	30.276	29.937	0.339
August	30.252	29.941	0.311
September . . .	30.057	30.032	0.025
Annual mean . .	30.065	29.942	0.123

TABLE II.

1876–77.

1876.	Mt. Washington.	Portland.	Difference.
July	30.244	29.948	0.296
August	30.308	30.027	0.281
September . . .	30.133	29.974	0.159
October . . .	29.893	29.890	0.003
November . . .	29.904	29.941	— 0.037
December . . .	29.586	29.863	— 0.277
1877.			
January . . .	29.692	30.029	— 0.337
February . . .	29.788	29.925	— 0.137
March	29.782	29.939	— 0.157
April	30.001	29.964	0.037
May	30.060	29.901	0.159
June	30.187	29.934	0.253
Annual mean . .	29.986	29.945	0.041

[1] It does not seem essential to reproduce here any except the more important curves of this series, as the numerical data contained in the tables are sufficient to indicate the nature of the results obtained.

TABLE III.

1877–78.

1877.	Mt. Washington.	Portland.	Difference.
July	30.228	29.910	0.318
August	30.246	29.926	0.320
September . . .	30.241	30.025	0.216
October . . .	30.075	30.011	0.064
November . . .	29.994	30.075	— 0.081
December . . .	29.921	30.073	— 0.152
1878.			
January	29.738	29.983	— 0.245
February . . .	29.763	29.912	— 0.149
March	29.802	29.893	— 0.091
April	29.924	29.836	0.088
May	30.032	29.882	0.150
June	30.148	29.898	0.250
Annual mean . .	30.009	29.952	0.057

TABLE IV.

1878–79.

1878.	Mt. Washington.	Portland.	Difference.
July	30.226	29.896	0.430
August	30.178	29 879	0.299
September . . .	30.338	30.153	0.185
October . . .	30.089	29.978	0.111
November . . .	29.798	29.878	— 0.080
December . . .	29.631	29.875	— 0.244
1879.			
January . . .	29.603	29.873	— 0.270
February . . .	29.653	29.961	— 0.308
March	29.864	30.068	— 0.204
April	29.782	29.832	— 0.050
May	30.181	30.017	0.164
June	30.138	29.917	0.221
Annual mean . .	29.957	29.944	0.013

Tables I., II., III., IV., give the differences between the mean monthly reduced heights of the barometer at Mt. Washington and Portland for the years 1873–74 (October–September) 1876–77, 1877–78, 1878–79 (July–June). The first column contains the name of the month; the second the

monthly mean barometer reading at Mt. Washington, reduced to zero and sea-level in the manner already described; the third column contains the reduced monthly mean barometer reading at Portland; and the fourth column contains the differences between these.

Now, were the corrections made in the same manner for the elevated station as for the lower station, that is, by the use of the ordinary formulæ of reduction to standard temperature and sea-level, these differences would immediately give us a knowledge of the differences in altitude of the elevated station that would be obtained by the barometric method from the means of different months in the year. And if we assume that the nature of the results is not greatly altered by the method of correction adopted for Mt. Washington (which is made, as I have already explained, by adding the constant 6.36 inches to the observed height at all times), we should draw the following inference: Since the differences are positive when the reduced reading at Mt. Washington is in excess of that of Portland, it follows that in proportion as the algebraic value of these differences is greater, the measured height of the mountain would be less.

Now, all four of the tables referred to show a maximum difference during July or August, which gradually descends until a minimum is reached in January or February. This would seem to indicate, as far as tables constructed from the data given indicate anything certainly, that the barometric results of observation during the summer months give the values too small, and during the winter months values too large, for the height of the station on Mt. Washington.

But, in consequence of the method of applying a correction for the elevation of the upper station, the tables thus constructed comprehend two sources of variation; first, the difference of the reduced heights of the barometer at Mt. Washington and Portland, *i.e.* the difference which would be obtained were a method of correction applied to each which was true at all times; and, second, the monthly variation of the barometer at Mt. Washington; that is, the variation of the monthly mean correction from the assumed annual mean correction of 6.36 inches.

To see if a study of these variations would throw any additional light on the subject, I have constructed tables and curves showing the monthly variation from the annual mean at Mt. Washington for 1876–77, 1877–78, 1878–79, by subtracting the mean reduced annual reading from the mean monthly readings. (Table V.) The mode of correction ap-

TABLE V.

REDUCED MONTHLY MEAN HEIGHT OF BAROMETER AT MT. WASHINGTON, MINUS REDUCED ANNUAL MEAN HEIGHT.

	1876–77.	1877–78.	1878–79.
July	0.258	0.219	0.269
August . . .	0.322	0.237	0.221
September . .	0.147	0.032	0.381
October . . .	0.093	0.066	0.132
November . .	— 0.082	— 0.015	— 0.159
December. . .	— 0.400	— 0.088	— 0.326
January . . .	— 0.294	— 0.271	— 0.354
February. . .	— 0.198	— 0.246	— 0.304
March. . . .	— 0.204	— 0.207	— 0.093
April	0.015	— 0.085	— 0.175
May	0.074	0.023	0.224
June	0.201	0 139	0.181

plied is evidently such that this is equivalent to subtracting the annual unreduced mean from the monthly unreduced means; the effect of the correction for elevation being simply to add a constant number to each. It will be seen that the height of the barometer at Mt. Washington is greater than the annual mean height during July, August, and September, coinciding with the annual mean about the middle of October, and is less than the mean during November, December, January, February, March, and generally at least a part of April; then ascending above the mean in May and June. The table of annual variation at Mt. Washington shows the total variation, arising from variation both in pressure and in temperature of the air.

Table VI. shows the changes in the *reduced* readings at Portland, which are considerably less than at Mt. Washington, as might be expected from the great effect of temperature variation at the upper station. It appears from these data

that the monthly variation from the annual mean is so great at Mt. Washington that we can hardly draw any very conclusive deductions from the tables and curves thus far considered, taken by themselves.

TABLE VI.

REDUCED MONTHLY MEAN HEIGHT OF BAROMETER AT PORTLAND, MINUS REDUCED ANNUAL MEAN HEIGHT.

	1877–78.	1878–79.
July	— 0.042	— 0 048
August	— 0.026	— 0.065
September	0.073	0.209
October	0.059	0.034
November	0.123	— 0.066
December	0.121	— 0.069
January	0.031	— 0.071
February	— 0.040	0.017
March	— 0.059	0.124
April	— 0.116	— 0.112
May	— 0.070	0.073
June	— 0.054	— 0.027

In the last Annual Report of the Chief Signal Officer (1879), which has been received by me since the present address was begun, there are published for the first time tables of unreduced barometric readings corrected only for temperature of the instrument and instrumental error, and not reduced to the sea-level. There is a table for the year 1878–79, and also one giving the monthly means ascertained from a series of observations extending through the six years from 1873 to 1878 inclusive. I have therefore calculated the mean monthly altitude of Mt. Washington above Portland for each month of both series, and constructed the curves shown in figures 1 and 2 of Plate VI. from these data. The data themselves are given in Tables VII. and VIII. In these the first column gives the month; the second, the reading of the barometer at Mt. Washington; the third, the barometer reading at Portland; the fourth, the monthly mean temperature at the former station; the fifth, the monthly mean temperature at the latter station; the sixth, the calculated altitude in feet; and the seventh, the differences between the heights computed from the annual and monthly means. Those corrections

which are unchanged by the season, as the correction for latitude, are not taken into account.

TABLE VII.

ALTITUDE OF SIGNAL OFFICE, MT. WASHINGTON, ABOVE PORTLAND, CALCULATED FROM MONTHLY MEANS OF BAROMETER, 1878–79.

	MONTHLY MEAN OF BAROMETER.[1]		MONTHLY MEAN TEMPERATURE.		Calculated Altitude in feet.[2]	Difference from Mean.
	Mt. Washington.	*Portland.*	*Mt. Washington.*	*Portland.*		
July . . .	23.865	29.844	50°.4	71°.6	6206.6	—40.1
August . .	23.815	29.830	47 .0	66 .4	6206.4	—40.3
September .	23.974	30.104	43 .5	62 .0	6222.9	—23.8
October . .	23.732	29.928	33 .3	54 .0	6217.4	—29.3
November .	23.433	29.833	17 .1	40 .0	6243.3	— 3.4
December .	23.272	29.827	6 .5	30 .5	6288.8	42.1
January . .	23.243	29.830	2 .1	24 .2	6236.1	—10.6
February . .	23.288	29.913	— 0 .7	24 .9	6251.5	4.8
March . .	23.505	30.015	13 .7	34 .0	6271.9	25.2
April . . .	23.416	29.778	17 .5	42 .6	6252.0	5.3
May . . .	23.819	29.962	37 .5	57 .7	6202.8	—43.9
June . . .	23.773	29.868	42 .8	61 .8	6228.0	—18.7
Annual Mean	23.595	29.894	25°.9	47°.5	6246.7	00.0

In the case of the curve for 1878–79, the mean monthly temperatures of the air to be used in the calculation were found, as usual, in the annual tables for each year; but in calculating the heights from the monthly means for the five years, the tables were less available, for the mean monthly temperatures of the air for the five years are not given, — an inconvenient omission. Hence it was necessary to compute those means from the monthly means for each year given in the various annual reports.

An examination of the curves both for 1878-79 and for 1873–78, which indicate the calculated altitude of the Signal Office at Mt. Washington above that at Portland, shows, on the whole, a greater elevation in the colder months than in the warmer ones. This seems to be an evident conclusion from curves 1 and 2.

[1] Corrected only for instrumental error and temperature of instrument.

[2] All constant corrections, as for latitude, etc., are omitted.

TABLE VIII.

ALTITUDE OF SIGNAL OFFICE, MT. WASHINGTON, ABOVE PORTLAND, CALCULATED FROM AVERAGE OF MONTHLY MEANS, FOR SIX YEARS, FROM JANUARY, 1873, TO DECEMBER, 1878.

	MONTHLY MEAN OF BAROMETER.[1]		MONTHLY MEAN TEMPERATURE.		*Calculated Altitude of Mt. Washington in feet.*[2]	*Difference from Mean.*
	Mt. Washington.	*Portland.*	*Mt. Washington.*	*Portland.*		
January . .	23.898	30.006	5.7	22.6	6246.3	9.6
February . .	23.867	29.929	6.5	25.7	6237.6	0.9
March . . .	23.899	29.887	12.8	33.2	6265.7	29.0
April . . .	23.542	29.874	21.6	42.4	6310.6	73.9
May . . .	23.702	29.897	32.1	53.9	6214.7	—22.0
June . . .	23.831	29.901	44.2	63.3	6214.8	—21.9
July . . .	23.894	29.900	48.3	69.1	6206.1	—30.6
August . .	23.921	29.949	47.1	67.0	6198.3	—38.4
September .	23.867	30.003	40.1	60.0	6217.7	—19.0
October . .	23.691	29.947	29.8	49.9	6229.0	— 7.7
November .	23.503	28.945	16.3	37.5	6257.1	20.4
December .	23.404	29.942	8.7	27.9	6240.3	3.6
Mean . . .	23.626	29.932	26.1	46.0	6236.7	00.0

These results are certainly quite unexpected, as they disagree with the results reached by the various European observers, and also with those obtained by Whitney in our own country. It would be quite rash to draw hasty conclusions from these curves, which embody the results of but six years of observation, especially as anomalies have occasionally been noticed in other cases. The results are, nevertheless, interesting, and we see here an attractive field for future labor and discovery. It would certainly be very desirable to extend the principles laid down by other observers in different parts of the globe to our own locality, and so to show the generality of their conclusions; and it would be still more curious if we were, on more extended investigation, to find out for a certainty that our results point to any local circumstances that lead to a different general rule among the White Mountains.

[1] Corrected only for instrumental error and temperature of instrument.

[2] All constant corrections are omitted.

As to the other allied question, whether the law is followed that the altitudes as determined by the barometer are greater in the warmer hours of the day than in the colder ones, there are no published tables of means which can be used in the determinations. In the Signal Report for 1873 there is a series of observations made at Mt. Washington (and also one made at Mt. Mitchell, N. C.), extending through May and June, in which minute observations were taken at different stations on the mountain. I have not been able in the time at my disposal to work up these results carefully, and they also extend through too short a time to lead to certain conclusions; but I hope at some future time to present to the Club some additional results relating to these facts. I have already examined a number of cases, and calculated the altitude of the mountain from them, and it is quite clear, in all of the cases that I have had time to consider, that the law holds; that is, that the height of the mountain, according to the barometric method, is greater when measured near mid-day, than if measured in the morning or evening.

And here I must close my sketch. It is, I know, very imperfect, and not as thoroughly digested as I could wish; for it can but bear the marks of having been drawn up in detached hours snatched from a most busy season. Yet I venture to present it, knowing well that the most minute contribution to a further knowledge of the laws and phenomena of Nature will be accepted by the Club in the spirit in which it is tendered.

I have called attention to a number of points that need investigation. But I have considered only a few in connection with the subject proper of my address. There are many others that might be mentioned, — questions of rainfall, moisture of the atmosphere, the transparency of the air, peculiarities of rain and mist-bows, abnormal appearances of the sun at its rising or setting, the temperature of the air, of springs, and of streams. There is no field in which we may not glean at least a humble harvest. For though Nature hides her secrets from the careless observer, she has still most wonderful tales to tell to the hearing ear, and will richly reward the earnest seeker. But he must be patient, and ready to accept

at each moment what she gives, whether it seems for the time little or great, knowing that even the smallest fact and the most familiar phenomenon has its own peculiar place in the order of the universe.

And who shall dare to think that even the great laws and phenomena of Nature or their applications are all known to us? As soon as we have grown familiar with one fact, we are taught another still more wonderful. The steamboat and locomotive have hardly grown old before the telegraph springs into being. While the land-telegraph is still but half developed, the depths of the ocean are conquered, and the continents tied into one. When the submarine cable has become so familiar that we cease to take note of the laying of a new one, and science seems, in this field at least, to have done its utmost, Nature opens a new insight into her laws, and the very accents of human speech are reproduced a hundred miles away. And not content with giving us the lightning to obey our slightest word, she makes even the sunbeam bear the pulses of the voice upon its wings.

And surely she will not stop here. Surely there are still more wonders, not only in heaven but in earth, than our philosophy dreams of; for the unknown and undiscovered transcends the known, even as the infinite transcends the finite.

Mount Cardigan.

BY HAROLD MURDOCK.

Read December 10, 1880.

FROM the highlands in the town of Hill, N. H., one looks to the south upon Ragged and Kearsarge Mountains, and northward to where the peak of Cardigan peers over the nearer hills. Ragged Mountain is only three miles distant in an air-line, Kearsarge is four miles beyond, and Cardigan is about eight in the opposite direction. Kearsarge is known throughout the length and breadth of the land; Ragged is

renowned as the nearest neighbor of Kearsarge; but concerning Cardigan, the loftiest of the trio, there appears to be an ignorance among mountain enthusiasts that is wholly unaccountable.

It lies between the towns of Orange and Alexandria, a huge three-crested mass of granite, whose general direction is north and south, and whose length of base is about five miles. The middle and loftiest peak is symmetrical in shape, has an elevation of 3,156 feet, and is known throughout the adjacent townships as "Baldface," a name by which I shall have frequent occasion to refer to it. The mountain sinks away to the west in a series of long slopes and broad terraces, but the reverse side is exceedingly precipitous. The eastern slope of Baldface is especially sheer, falling almost perpendicularly for 1,700 feet into the forests below, while the spurs from the flanking peaks running out to the east enclose a deep and picturesque ravine that forms one of the chief attractions of the mountain.

The majority of those who ascend Cardigan go up from the Orange side, leaving the Northern Railroad at East Canaan, and driving thence to the base, a distance of six miles. From this point it is a gradual climb of fifty minutes through a narrow belt of woods and over the smooth ledges. There is but little of interest in this ascent, though one cannot fail to be impressed with the sheerness of the eastern slopes as seen from the summit. The mountain as viewed from this side, from East Canaan and several points on the Northern Railroad, shows too great length to enable one to appreciate its height. The language applied by Starr King to Mount Washington, as seen from Conway, is very applicable to the view of Cardigan from East Canaan: "The leonine grandeur is there, but it is the lion not erect but couchant, a little sleepy, stretching out his paws and enjoying the sun."

To fully appreciate Cardigan one must see it from the east, from the waters of Newfound Lake, or the Alexandria meadows. Baldface shows a symmetrical dome sharply cut against the sky, the minor ridges on the right and left serving to enhance its prominence. The lower slopes are covered with forests, but the gray and lonely summits tower a thou-

sand feet above the trees. The rocky walls are torn with ravines and chasms, while broad veins of white quartz glisten like snow upon the upper slopes. View this mountain from the Alexandria meadows toward sunset on a summer day, and you will see a boldness of outline and delicacy of color that are rarely excelled among the more pretentious elevations of northern New Hampshire. Cardigan usually takes the snow from three to five weeks earlier than the valleys at its feet. Indeed, it often shows the only snow-capped peak in the State, south of Warren.

We had some difficulty in finding out the best way to reach the mountain from the Alexandria side, as the inhabitants in the vicinity regarded it with a sort of dread that was enhanced by their ignorance of everything concerning it. The peak of Baldface from the southeast certainly does look a little forbidding to any save those who enjoy the grand and awful in nature. A county map put us right, however, and on a clear, cool morning, with one companion, I set out on the twelve-mile drive for the base. After three hours of jolting and uncertainty we halted at the Holt place, a tumble-down house and barn at the terminus of the road, with the rocky wall of the mountain literally overhanging us, and the wind blowing with a force that boded ill for our comfort on the summit. Starr King, viewing Cardigan from Prospect Mountain, styled it "desolate." Had he been with us on this day, his ideas of its desolation would have been confirmed. The barren and rocky pastures, the sheer and rugged sides of the mountain darkened by cloud shadows, the dilapidation of the buildings and their occupants, and the roaring of the wind through the forests about us, gave an impression of squalor and loneliness which I shall never forget. We consulted our barometer before starting, and found the house to have an elevation of about 1,400 feet, leaving over 1,700 feet to be surmounted.

After signally failing in our attempts to extract any useful information from the proprietor of the buildings, we were fortunate enough to find a bright boy of twelve, who gave us a variety of directions for finding the path, and concluded by assuring us that we could not miss it. We had never seen a path that we could n't miss, and consequently were anxious

to behold this one. In fact, previous experiences on the adjacent hills had led us to consider ourselves experts at all kinds of path-losing. We climbed the slippery pasture, found what we thought to be the path, entered the woods, and in five minutes more were beating about in a bog, surrounded by a perfect wilderness of tangled shrubbery, lost as completely as we could well be. Fighting our way through the woods, we came out again in the open pasture, and made across its slippery incline toward the northern ridge of the mountain, determined to go up without a path. We have always been thankful we lost that path, for, by going up this ridge, we obtained an idea of the grandeur of Cardigan that no other ascent has ever furnished us. Five minutes through the woods, and we came out upon the ledges that fell off precipitously into the ravine at our feet. Across this ravine the whole mass of Baldface was visible, sweeping grandly from the forests to the cloud-shadowed crest above. The higher we climbed the deeper looked the ravine, and the lines of Baldface grew bolder and more sheer. Views began to open on all sides, blue crests peered over the encircling hills, and yet we were so absorbed in the increasing grandeur of the mountain on which we stood that we scarcely noticed them.

An hour and a quarter from the house brought us to the crest of the ridge, which our barometer indicated to be 3,030 feet above tide-water. Of the character of the climbing, it is only necessary to say that it was hard, a good scramble on all-fours for nearly half the way. We had to cross a couple of deep ravines, and encountered no end of steep ledges, where it became necessary to throw all baggage ahead, and climb, with the aid of the crevices in the rocks and a few straggling evergreens. On this summit there are a few detached boulders that are broken into the most fantastic shapes. A walk of half a mile along the backbone of the ridge brought us directly under Baldface, which, though quite steep and rough in appearance, can be ascended without much difficulty. Its summit, which is less than an acre in extent, is formed of ledge so smooth that it is almost impossible to find a depression or elevation upon its surface to protect one from the force of the wind.

Of the view I can only give a general idea. The White Mountains from Moosilauke to Ossipee are visible, Lafayette showing a jagged peak, and Washington a heavy dome with a long spur running off to the right. The Waterville Mountains and the Sandwich range show to good advantage, the slide on Tripyramid being a conspicuous object in the landscape. The Uncanoonucs and Monadnock loom on the southern horizon, and to the left and beyond the latter is a faint blue curve that we decided must be Wachusett. Ascutney and the Killington peaks were all we recognized for a certainty among the Green Mountains. Winnepiseogee shows a broad expanse to the left of Gunstock. Newfound Lake is visible for nearly its entire length, being only five miles distant. This lake, although extremely beautiful when viewed from the lowlands, is too deficient in islands and promontories to compare with Winnepiseogee from Red Hill or Prospect. There are no views of broad and fertile valleys, as there are from Kearsarge, while the number of villages in sight is quite limited. One looks down on all sides upon the white trunks of dead forests and upon the broad backs of hills that bristle with gray ledges and scrub spruce.

The view from Cardigan, as a whole, is far less beautiful than that from Kearsarge, and yet it has a charm of wildness about it that prevents one from pronouncing it inferior.

Those who object to skirting precipices and climbing on their hands and knees can reach the summit of Cardigan in comparative comfort by a path that starts about a mile south of Holt's, and strikes up the mountain between Baldface and the southern ridge. Teams are left at the farm-house of Aaron Clark, whose name deserves mention from the fact that he cut the path, and is well posted on everything concerning the mountain. A steep pasture must be climbed before we reach the path at the edge of the woods, and this is considered the hardest part of this ascent. The path leads through the woods for over a mile, and is very distinct for almost the whole distance. On emerging from the forest upon the bare ledges the trail is no longer visible, and one is obliged to make his own way to the summit. This is by no

means a difficult matter. By bearing slightly to the left and skirting the shallow ravine that lies between Baldface and the southern peak of the mountain, the ascent to the summit can be made without any serious impediment.

Last August, a party of fifteen from Hill ascended the mountain by this route. A dozen of them were Bostonians, and three of us were members of the Appalachian Club. Wherever the path was vague we erected cairns, though, after striking the ledges, loose stones became so scarce that cairn-building was impossible. Coming down, we discovered a delicious spring of water, deep in the shadow of a rock, and concealed by underbrush. As we found it during the severe drought, it is doubtless uncommonly reliable. We erected a conspicuous cairn here, and blazed the trees about it. Its location is about a quarter of a mile above the forest, in one of the tributaries of the ravine that runs between Baldface and the southern peak. The distance from Clark's to the summit by this route is about two miles.

Before leaving Cardigan, let me narrate the experiences of a party of four in descending the northern ridge three years ago. We had had a hard scramble up, and were determined to find a better way down. Each had a different idea, and finally, to avoid trouble, we yielded to the senior member of the party, who made the boast that he had never yet been led astray on any mountain. We followed him with blind confidence. We entered a rocky chasm, which began to descend at an uncomfortably steep angle, but which our leader assured us would be better farther down. On the contrary, it grew worse. To complicate matters, a fissure appeared beneath us, which widened the farther we descended, until we could no longer use our feet with confidence. We kept our position by using our knees and palms as brakes. Overcoats and mountain sticks were thrown ahead, and we travelled without superfluous weight. The fissure had widened to nearly two feet, and we were in momentary danger of falling into it. To return was impossible, for we could never climb up those steep and slippery rocks. We made all kinds of unpleasant remarks to our guide, who was too much out of breath to reply. At length a gleam of sunlight streaming through a rift in the rocks revealed the chasm below us to be quite shallow at this

point, and our leader, dropping in, found the depth to be only about eight or nine feet. Hot and tired, with our clothes and arms torn on the jagged rocks, we were glad of an opportunity to stand squarely on our feet once more. We all let ourselves cautiously into the fissure, and to our amazement found ourselves in something resembling a cave. We walked several yards beneath the rocks, and seated ourselves on a smooth ledge, with a stream of water plashing along by our side. The fissure above afforded all the light that was necessary, and here in this delightful retreat we lay for fifteen minutes, drinking the water and washing our wounded arms.

There was only one thing that marred our appreciation of this lovely spot, and that was the anxious uncertainty as to how we were to get farther down that dreadful chasm. We crawled out into the daylight again, and were gratified to see that the rocks below would afford a fair footing. We now considered our difficulties as over, but were doomed to disappointment. In a few minutes we came out on the edge of a precipice with a suddenness that nearly took our breath away. A huge shelf of rock hung far out over us, and from it little streams of water were trickling on the rocks below. Beneath us lay the silent forest with wreaths of smoke curling up from it, partially screening the noble mountain mass that rose beyond, wrapped in the purple shadows of afternoon. For a minute we forgot our predicament in the beauty of the scene. We came to our senses all too soon. Before we reached the base of the mountain we were obliged to skirt the precipice for nearly a quarter of a mile, descend into a scrubby ravine two hundred feet deep, and climb the other side. At the close we hardly knew whether to bless or curse our bewildered guide.

Though I never have seen these same spots on any subsequent ascent, yet I am convinced that this northern ridge of Cardigan is well worthy the study of any lover of nature. The base is only ten miles distant from the railroad terminus at Bristol, where there is a good hotel. I feel confident that those who at any future day may ascend Cardigan in this way will agree with those who have gone before, that it possesses attractive features that are seldom found on mountains of its height.

A Sojourn in Andover, Maine.

By Gaetano Lanza.

Read October 14, 1880.

My summer peregrinations led me to spend about a month in Andover, Maine, and, my Appalachian conscience reminding me that my duties as a member of the Club had been rather poorly attended to in the past, I endeavored to quiet its throes by taking with me the following instruments, viz.: a Casella aneroid barometer kindly loaned by Professor Ordway, a thermometer belonging to the Institute of Technology, the Club camera, a heliotrope, and a pedometer. I was enabled to sleep soundly amidst this array of instruments, because I had previously been assured that unless I took them they would remain unused. Thus armed and equipped, and having provided myself with Farrar's Guide-book to the Richardson and Rangeley Lakes, and Hitchcock's Map of the White Mountains, I started for my destination. While the amount of work done is by no means comparable either with the number of instruments or the length of my stay, yet I have some facts to lay before the Club, which will, I think, prove of interest.

In the valley of the Ellis River, a branch of the Androscoggin, lies the village of Andover, entirely surrounded by mountains varying in height from about two to four thousand feet above the sea. It is at a distance of about twelve miles south of Lake Welokennebacook, and on the road from Bryant's Pond to the lake. In general appearance this valley has been, not without reason, compared with the Intervale at North Conway, although it is not by any means so grand and imposing.

Of the mountains, I selected three, forming nearly an equilateral triangle, as good points from which to heliotrope to the Coast Survey on Mount Washington; but, alas, this heliotroping proved useless, as will be hereafter explained. The three were Bald Pate (Bear River Whitecap), the highest,

lying to the west of Andover, its upper part consisting of bare rocky ledges; Old Blue, nearly as high, to the north of the town, and wooded, with the exception of the summit, and a few bare places near the top; and Whitecap, the smallest, to the southeast, whose upper part also consists of bare ledges.

I made two ascents of Whitecap, two of Old Blue, one of Bald Pate, and one of Long Mountain, and, by good fortune, I never had to make an ascent with less than two companions, while, in some cases, our parties were very large. I can perhaps best explain my work by describing each of these ascents successively, stating the results obtained. The heights, however, I will place in a table at the end of this paper.

My first ascent of WHITECAP was made on July 26th, the second, on August 22d. This mountain, of which a large part of the upper portion consists of bare rock, is much frequented by blueberry hunters. There are probably a number of well-marked paths, of which I followed, in both cases, that which is most used, and which starts from Mr. Howe's house, a little off the road that leads from Andover to Farmer's Hill. The distance from Mr. Howe's house to the summit, by this path, is about two miles, of which about one-third is in the woods, the remaining two-thirds being on the ledge. There is a spring near the path, but it is not easily found, and, moreover, is sometimes dry, so that, as there are only pools of rain-water on the summit, and some pitcher-plants a little below, I should advise any one making the ascent to carry water up from Mr. Howe's. I was told by Mr. Edmund Bailey that an easier path starts from a point on the Farmer's Hill road, some distance beyond Mr. Howe's; but I had not the time to explore it.

On both trips I took barometric measurements, and on the second, I carried the Club camera to the summit, and took two-thirds of the horizon. The day was superbly clear, and the White Mountains were very distinct. This part of the view was truly magnificent, and the following are some of the principal features: Madison, Adams, Jefferson, Washington, Carter, Carter Dome, Baldface, Doublehead, and the

Northern Kearsarge. The buildings on Washington and Kearsarge were plainly visible. Two or three distant summits, which were not represented in the camera, I was enabled by the use of a glass to add to the profile. Of the mountains in Maine, Mt. Abraham and a host of others were visible, with but few of which I am familiar; indeed, I have to thank Mr. J. R. Edmands and the map of Mr. W. H. Pickering for valuable assistance in identifying the mountains in this profile.[1] I can scarcely doubt, however, that a glance at the plate will convince any one of the fact, which so deeply impressed me as I gazed from this summit on the surrounding panorama, that here is an almost boundless opportunity for interesting Club work in a region of which there is but little known, and which there is every incentive to explore.

The above is practically all that I accomplished from Whitecap. As to improvements in the path, the only suggestion I should have to make would be the construction of a substantial fence on the lower side of the road leading from Mr. Howe's house to the Farmer's Hill road, as it is now really dangerous for driving. A fatal accident, I understand, has already occurred there from the running away of a horse.

OLD BLUE lies, as I have stated, to the north of Andover, and is almost entirely wooded, the only exceptions being the summit, and a few bare places near it. Indeed, the summit itself is covered with a low growth of spruce about a foot high, but just below is a bare rocky ledge.

I was told the ascent of Old Blue would be difficult. The last ascent, so far as was known, was made about thirty-five years ago by Mr. Silvanus Poor and one of his sons, who, by following a logging-road which was now certainly overgrown and no longer recognizable, had succeeded in reaching a bare place, which was either the summit or quite near it. They then came down in the rain to the lake road by a compass line, passing over some ledges on the lower part of the mountain, which, as seen from the lake road, certainly look very uninviting. There was also a new logging-road which

[1] See Plate VII.

skirted the side of the mountain, and ran for some distance beside Beaver Brook; but if this logging-road were followed to its end, and the ascent then made by compass line, one would probably be led to the ridge very far east of the summit. The travelling along this ridge, covered as it is with a thick, low growth of spruce, would be by no means pleasant. To take a course which would lead over the ledges near the lake road, referred to above, looked decidedly unpropitious.

Beaver Brook, however, forks at a point not very far from the beginning of the logging-road, and a study of the mountain with the glass and compass seemed to indicate that the safest, though not the shortest, way would be to follow the left fork until it became too small to follow any longer, or proved disadvantageous for some other reason, and then to take a course probably slightly west of magnetic north. These were the conclusions at which I arrived, and in which I was supported by Mr. Edmund Bailey, of Andover, who accompanied me in both of my ascents. The first ascent was made on Thursday, July 29, and one of the party was a lady, the first who had ever ascended the mountain, and who had the courage to undertake the trip, notwithstanding the predictions of the terrific reception that Old Blue would give to any one who should attempt to intrude upon its solitude. The second ascent was made on August 23. Each time we proceeded on a buck-board from Mr. Silvanus Poor's house, where we were staying, to the Devil's Den on the lake road, and there left our horses and buck-board in charge of his Satanic Majesty. We then walked along the road about three-eighths of a mile to the logging-road referred to above. This we kept as far as Beaver Brook, and then followed the left-hand branch of the stream, until, after having travelled about two miles and a half, we came to a point where it forked again. Which fork should we take, the right or the left? In the first ascent we were persuaded to take the left-hand branch, by a fact which ought never to influence mountain climbers in such a case; viz., the direction of the left-hand branch just at the forks was almost exactly magnetic north, whereas the course of the right-hand branch at the same point would seem to lead much farther to the east.

Following, therefore, the left-hand branch, we soon found ourselves on a lower ridge of the mountain, from which we could see that there was a much higher ridge to the east, and that the summit evidently was in that direction. We therefore had to descend a short distance and proceed to mount the higher ridge. Thus we finally reached our destination. The character of the travelling was, on the whole, very good. For a large part of the way we had followed the brook, and the growth on its sides being high, the first part of the way was quite easy. As we neared the summit we encountered a little treacherous footing, and when within about a quarter or a third of a mile of the summit we had to scramble through a growth of thickly woven spruce, about the height of a man. This was really the only part of the journey that presented any serious difficulty.

On our second trip we were careful when we reached the second set of forks to follow the right-hand one. By this means we were carried much farther to the east, and reached the belt of scrub at a point where it was much narrower. In ascending, however, we found a third set of forks, and here again we took the left-hand one, but should have done better, as we afterwards ascertained, to take the other.

Hence to ascend Old Blue by Beaver Brook, I should recommend following the logging-road from the lake road to the first set of forks. Here take the left-hand branch of the brook, and subsequently, whenever forks occur, always take the right hand. Finally, when the brook disappears, follow a compass course nearly due north to the summit. On our second trip, four hours and a quarter were required to reach the summit from Devil's Den. This could be somewhat reduced if a path were constructed beside the brook, and a passage were cut through the scrub at the top; but I hardly think it could be diminished to less than three hours and a half, except by very rapid walking.

Another path might, however, be constructed which would, I think, reduce the time required for the climb to about two hours. For this purpose one should provide himself with an axe, and make the ascent as described; then, in descending, cut a path through the narrowest part of the belt of scrub,

and cut and blaze below that a straight path to a point on the lake road a little to the left of the ledges referred to above. It was by this route that we made the descent in both our trips, although in the first one, by going a little too far to the right, we found ourselves part way up on the ledges and had to descend.

So much for the path; next as to the brook. While it does contain a number of most lovely and attractive cascades and waterfalls, and fully repays the trouble of visiting it, I do not consider it equal in this respect to some others in the White Mountain region.

The view from the summit, however, is truly magnificent. On the west we have, besides the nearer mountains, whose name is legion, a panorama of the White Mountains, more extensive and grander than that seen from Whitecap, as the mountain is higher. I did not spend much time in identifying them. While more are seen, I do not think that any of those that are visible from Whitecap are cut off from Old Blue. Then, on every side we have, of course, a broad sea of mountains in Maine, which are more than sufficient to make the mouth of the most enthusiastic explorer water. To the northward are visible, if I remember rightly, parts of Lakes Welokennebacook, Umbagog, and Rangeley, the view of the remainder of the lakes being cut off by a near mountain lying to the north of Old Blue, and of about the same height, perhaps a little higher.

Old Blue itself is a very long mountain, and the ridge, which is a little curved, is evidently covered with scrub, and would be very difficult to explore; indeed, I think a visit to other parts of the ridge would hardly repay the labor of reaching them, as it is hardly probable that any additional view would be gained.

Of Bald Pate, as this mountain is called by the people of Andover, I made but one ascent, on Monday, August 2. We rode to a point on the Upton road, then proceeded on foot along a good logging-road to its end, and finally a short and steep climb in the woods brought us to the ledges, whence it was easy to reach the summit. The

climb is long, about three miles and a half, but presents no difficulty. A little more blazing and some sign-boards would be desirable. This is probably the shortest route from Andover. I was told that there was a much longer path, leading also from the Andover side, which passes over the ridge; also, that there was a much shorter and easier path from the other side. To make use of it, one should drive to Newry Corner, about seventeen miles, and then follow up Bear River for about six or seven miles to the path. This mountain is very productive of blueberries, and this latter path is, I believe, much used by blueberry hunters. The view is of a somewhat different character from that to be obtained from Old Blue, but, on the whole, I can hardly say that it is superior. The view of Bald Pate from Andover is probably finer than that of any other one of the surrounding mountains, its bare and rocky ridge standing out in strong contrast to the generally wooded summits around it.

On August 15 I made an ascent of LONG MOUNTAIN. Starting from Mr. Poor's house, we went across the fields in a northwesterly direction to Farrington's Hill; then by an old wood-road to Winslow's opening; thence up the logging-road to the logging-camp; and from this point followed the town line, marked by blazes on the trees, to the summit. This is wooded, but by climbing a tree we obtained a splendid view, embracing the entire horizon. The Carter range is very distinctly seen, as well as Lake Umbagog. In descending we struck a northeast course for Andover, which we could see from the summit, and came out a little above Mr. Dunn's house at the head of Lover's Lane.

The climb itself is not difficult, but, with the exception of the logging-camp, is rather uneventful. The top of this mountain ought to be, and could very easily be cleared. It would then afford a splendid view-point, somewhat different from any of those I have thus far described. A couple of men could easily perform the work in half a day.

Having thus described my separate trips, I will say further that the weather was exceedingly unfavorable, the only clear day during my stay in Andover being August 22, when I took

my camera views from Whitecap. On almost all my other trips I started with a clear sky, and reached the summit to find it hazy, or else to find Mt. Washington in a cloud, and returned in a pouring rain.. I drilled holes in the summits of Whitecap, Old Blue, and Bald Pate, and, notwithstanding the haze, sent a flash to Mt. Washington from Bald Pate on August 1, and from Old Blue on August 23, but in neither case was any answer received. I suppose the haze prevented my signals from being seen. Mr. Bailey, with whom I left my heliotrope, writes me that he had similar want of success on Whitecap on September 23, and that from August 26 to September 23 the wéather had not once been clear.

On Old Blue we deposited an Appalachian bottle, which contains some suggestions as to the route to be taken in the ascent and descent. Should a path be constructed up Old Blue, I should recommend the removal of this bottle.

Not finding any place in Andover from which I could obtain one continuous camera profile of all the surrounding mountains, I took one-half the horizon from the hill back of Mr. Josiah Talbot's house, and the remainder from that back of Mr. Bailey's, thus obtaining a complete panorama of the mountains surrounding the valley in which Andover is situated. These camera views possess a good deal of interest, although not so much as attaches to that taken from Whitecap.

The barometer was also put to use. Through the kindness of Mr. Hannaford, of Montreal, the chief engineer of the Grand Trunk Railroad, I have been informed that the height of the rail at Bryant's Pond station is 698.82 feet above mean high water at Portland. My barometric determination gave me 725 feet as the height of the rail at this place above the rail at the Grand Trunk station in Portland, and 650 feet as the height of Mr. Poor's house in Andover above the same point. It seems, therefore, fair to assume that this house is 75 feet below the rail at Bryant's Pond station, and consequently 624 feet above the sea.

The heights of several points above Mr. Poor's house are as follows: —

	Feet
Arm of Lake Welokennebacook	832
Road near Devil's Den (mean of five measurements) . .	324

	Feet
Mr. Howe's house at the foot of Whitecap (mean of four m.)	248
Farrington Hill (one measurement)	238
Bridge over Ellis River on Farmer's Hill road (m. of two m.)	—45
Summit of Whitecap (mean of four m.)	1582
Summit of Long (mean of two m.)	2457
Summit of Old Blue (mean of four m.)	3027
Summit of Bald Pate (mean of two m.)	3372

In accordance with the above determinations, we shall have for the height of these summits above mean high water at Portland: —

	Feet
Summit of Whitecap	2206
Summit of Long	3081
Summit of Old Blue	3650
Summit of Bald Pate	3996

As regards the maps of this district, it may be said that the one in Farrar's Guide-book is quite erroneous, and so also is the "County Map." I do not know how the mountains were located on these, but I should think it must have been done largely by guessing. In Mr. W. H. Pickering's map,[1] which was issued only a very short time before I left Andover, the mountains for whose positions he assumes the responsibility are accurately located, while the positions of those which he incorporated from the county map are not definitely given, being subject to the errors of the latter.

Of the places of interest in this region the most remarkable is, perhaps, the Devil's Den, a large and deep pot-hole in a ledge in Black Brook, which exhibits most wonderfully the action of a rotating stone in cutting out such a hole. The ledges in the brook near the Devil's Den are also well worth a visit. Another place of interest which is much visited is Rumford Falls, a very fine cascade in the Androscoggin at Rumford. Its beauty is, however, somewhat marred, although its usefulness is increased, by the proximity of a saw-mill. A third is Farmer's Hill, from which a magnificent view is obtained, somewhat like that from Whitecap, but not nearly so extensive. The cataracts in the cataract brook on Bald Pate, and also Dunn's Notch, are said to be very interesting places, but I did not visit them. I do not doubt, however, that

[1] See APPALACHIA, Vol. II., Plate V.

an exploration of the numerous brooks in the surrounding mountains would increase very considerably the number of these places of interest, and give to the artist many new studies, and to the climber much added pleasure.

Andover is, indeed, a most interesting region from which to make explorations, and whatever efforts should be made by our Councillors on exploration and improvements to render more easy of access the mountains in this vicinity would be well directed, not merely by reason of their beauty, but also because they form, as it were, a connecting link between the White Mountains on the one side, and, on the other, the lakes and the most interesting mountain region of the State of Maine.

The Love of Nature among Americans.

By Charles E. Fay.

Read March 9, 1881.

In the October number, 1880, of "Mind," a quarterly review of psychology and philosophy, is an interesting sketch of "Æsthetic Evolution in Man," by Mr. Grant Allen. A certain passage in one of its paragraphs, supported directly afterward by another of similar tenor, is calculated to excite surprise and pique our national pride.

The paragraph is so short that it may as well be presented in full. It reads: "But we must never forget that the taste for scenery on a large scale is confined to comparatively few races and comparatively few persons among them. Thus to the Chinese, according to Captain Gill, in spite of their high artistic skill, the 'beauties of nature have no charm, and in the most lovely scenery the houses are so placed that no enjoyment can be derived from it.' The Hindus, 'though devoted to art, care but little, if at all, for landscape or natural beauty.' The Russians 'run through Europe with their carriage windows shut.' Even the Americans in many cases seem to care little for wild or beautiful scenery. They are more attracted by smiling landscape gardening, and, as it

seems to us, flat or dull cultivation. I have heard an American just arrived in Europe go into unfeigned ecstasies over the fields and hedges in the flattest part of the Midlands."

I confess, the stricture upon our national taste is so worded that one is at a loss to know whether to take exception to it or not. "Even the Americans, in many cases." The first expression hints that better things might have been expected of us, while the phrase "in many cases" seems in the connection wholly meaningless. If it means anything, it should have prevented Mr. Allen from mentioning us at all among his illustrations of races lacking "taste for natural scenery on a large scale," after his restriction of the appreciative taste to comparatively few persons among the appreciative races.

But directly, as a mordant to set the dubious color of this statement, we find another passage, this time of no uncertain sound, and at once as suggestive of doubts as to our critic's fairness as it is derogatory to the cultivation of Americans of the educated class.

Speaking further of the appreciation of nature in its productive, agricultural aspect, he says: "Even in our own time and place, amongst our own race, one may see a similar æsthetic level with farmers and laborers." This is supported by a story in point of a Lincolnshire yeoman, and reinforced by the following: "'Your country, sir,' says a distinguished American visitor in England, 'is very beautiful. In many parts you may go for miles together and never see a tree except in a hedge. Nothing more beautiful can be conceived.' (I take the words down from the report of an 'interviewer.') To the farmer, hills like those of Devonshire were mere obstructions to ploughing; in the eyes of the practical American, trees were simply objects to be stumped and annihilated in the interests of good farming." Now, had the person here quoted been represented as a farmer or laborer, or as in any way interested in agriculture, well and good. He is introduced simply as "a distinguished American," and the inference is almost inevitable, that he represents what is most characteristic in American society, culture included.

We do not therefore seem to ourselves over-sensitive if we

conclude from these statements that to Mr. Grant Allen, a writer of established reputation, the pioneer of the æsthetics of Darwinism, and, as we have supposed, especially strong in observation and analysis, we seem to be a people so eminently practical as to leave little or no room for the æsthetic element. According to him we must part company with the Germans, our cousins of Great Britain, and the one or two other nations to which he would perhaps allow the appreciative sense, and join his Chinese, Hindus, and Russians.

Fully assenting to his restriction of the appreciative class to the comparatively few, we venture the assertion, that the number of individuals truly appreciative of the wild and beautiful in natural scenery is proportionately as large in America as in England, or perhaps any European nation. The statement, if not susceptible of proof or disproof, certainly admits of argument.

First, upon *a priori* grounds. Why should not the American be as open to these influences as, for example, the Briton? The race is the same, with doubtless an increase of susceptibility to emotion caused by the intermingling of German and Celtic mysticism and fire in our blood, and our more stimulating climatic influences.

If it is permitted to speculate with reference to the basis of Mr. Allen's conception of us, we should suspect it to rest less upon the illustrations which he presents, than on his belief that we are a *practical* nation, and that the terms "practical" and "æsthetic" are mutually exclusive. Let us then consider the significance of this epithet, so justly applied to us.

Practicality is a supposed attribute, of which our people is recognized as easily the best exponent. Indeed, the distinction is constantly thrust upon us of having given to an astonished civilization the first modern illustration of a purely practical nation. As interpreted by Europeans, we have little reason to be proud of the distinction, for it signifies a people competent only to inventions which tend to increase the sum of human comfort, bent only upon the acquisition of wealth, great in audacity, whether to plan and execute conquests of Nature and the enslaving of physical forces, or monster finan-

cial schemes, soulless and cruel, — a people "whose glory is in their shame, who mind earthly things." The wail of Sismondi when Mme. de Staël had formed her purpose, never executed, of coming to this country, to this day expresses the esteem in which we are held, it is not too much to say, by the majority of Europeans of some education. Some American journals having had the bad taste to take the financial measure of the great Frenchwoman, he bursts forth: "It is among such miserable calculators as these that she is going to pass some years! Oh, how much pain both for those who go and for those who see them go!"

But how shallow the philosophy then, and how inexcusable to-day in view of intervening developments, which does not recognize the fact that practicality is not an attribute, but a phenomenon; not a force, but a direction of energy; not something destined to strengthen and increase, but to yield to a something higher and better. As well sneer at the bulb sordidly swelling in the damp mould, forgetting the blossom that is transforming this matter into beauty.

This practicality of ours seems to me the product of three factors: our race-energy, our liberty, our peculiar situation in a new and undeveloped country, plus a modicum of selfishness, which, I dare say, is not monopolized by Americans.

Now, of these things, which combine to make us practical, which tends, necessarily, to exclude the æsthetic? Certainly neither of the first two. These tend rather to give it a greater breadth and depth when it shall have been called forth. What is our energy but power spurred by sentiment, finding its vent in the father, in the family's day of small things, in the amassing of wealth; but in the educated son, in the zealous pursuit of literary or scientific study, or a profession, and in his vacations in conquering the high peaks of the Alps. Is not liberty — "liberty protected by law" — the ideal atmosphere for the development of the grander sentiments which are called into play by the spectacles of Nature?

To the third factor, our circumstances in a new country, we must look for whatever is inimical to the development of taste in all its higher forms. Ideals cannot be high so long as material development remains the paramount consideration.

But while energy and freedom are constants, this is a factor destined inevitably to diminution. Our social history is so irrefutable a proof of this, that the statement needs no comment. The advantages, on the other hand, which our æsthetic development has derived from our environment we shall shortly have occasion to consider.

But if it be admitted merely that the foundation to be built upon is equally promising in the Anglo-American as in the parent race, it behooves us to ask what æsthetic education our people has lost which their cousins descended from those who stayed at home have enjoyed. Doubtless, the cultivating influences of art. Mr. Allen asserts that "beauty in art prepared the human mind for beauty in Nature." While, as a general statement, we are forced to believe that beauty appreciated in Nature antedates beauty transcribed in any high form of art, it can well be conceded that the general æsthetic tone and susceptibility of a people must be enhanced by the presence of art. We have had no old cathedrals, no stately castles, no rich galleries; and we have missed them, too, in some directions, but not in this, for the loss has been more than compensated, as we shall see.

If, in replying to Mr. Allen, it may be permitted to quote from one with whose principles and methods he is so little in sympathy, let me ask you to listen to M. de Laprade, a writer treating the history of the sentiment of Nature with a method at once poetic and philosophic. Discussing the poetry of the Renaissance period, he says: "In order that the true sentiment of Nature, the love of landscape, the expression of the harmonies of the external world, should fill a larger place in poetry, it was necessary that Nature herself, the globe which we inhabit, the celestial spaces which encompass us, should be increased before the gaze and in the imagination of races, in the train of great voyages and great astronomical discoveries. It may be affirmed with all accuracy that each development of the sentiment of Nature since the Middle Ages corresponds to some peregrination through an unknown land, to some navigation of thought among new stars."

"The epic of Camoëns, called into being by the discov-

eries of Vasco da Gama and the first dazzling of a European soul brought face to face with the Oriental landscape, is the most ancient monument of our Christian poetry in which Nature holds a prominent place and plays an independent rôle."

Treating the same sentiment in French literature, he says: "Chateaubriand is the father of modern poetry." "The love of the country, rendered fashionable by Rousseau, is about to become a sort of worship of Nature, thanks to distant voyages. It is from the virgin forests of the New World and by the author of 'Attala' and 'René' that the true sentiment of the harmonies of creation has been introduced among us."

But Mr. Allen himself shall be our witness here. He says: "We can hardly expect a taste for scenery to develop amongst people who necessarily live (like all but the most civilized) in one narrow place all their days. . . . The habit of making tours, at first confined to the very wealthy, but gradually spreading down to the middle classes and the mass, has undoubtedly had an immense effect in strengthening the love of Nature."

More impressive than the scenery of most of the lands he then names as open to the tourist of to-day were the scenes of the New World on which the eyes of René might have rested. It was into the midst of the same scenes — wild, strange, and hence inspiring — that our ancestors came. The more cultivated among them cannot have failed to be stirred in a similar way to Camoëns and Chateaubriand by experiences that had little moved the souls of men since old Homeric times.

This for our ancestors. Have their descendants enjoyed especial advantages for the stimulation of this taste? If even the average man cannot fail to have a new set of emotions stirred by the aspect of scenery of an utterly unfamiliar character, what modern nation has had the schooling of our own? What wonders of Nature have not this people confronted, restlessly pressing through the primeval forest, along the banks of the mightiest rivers that roll their widely gathered tribute to the sea, threading the vast chain of ocean lakes, across the prairies, gazing first of civilized men upon the marvels of the

Rocky Mountain peaks, parks, and cañons, forcing the last barrier of the Sierras, and pausing not until checked by a new ócean, laving a land as different from that on which the fathers landed as northern Italy is from England! The tide has known no cessation. No generation has failed to come under its potent influence. Has the less stolid race held out against it? I think not.

But it is one thing to show why a thing should be, and another to show that it is. What evidence have we that the class of those who are appreciative of natural scenery among Americans is as numerous as the same class in Great Britain? Or rather, to put it somewhat differently: What evidence have we that the average sentiment is as high on this side of the Atlantic as on that? For it is a fair assumption that, if the average sentiment is as high in one country as another, the class of those possessing it in an especial degree will, other things being equal, be as large in the one case as in the other. Let us not overlook all the importance of the phrase, "other things being equal." Chief among these "other things" must be counted the average intelligence, the equable distribution of wealth, permitting leisure to people of the great middle class, the facility and cheapness of transportation to new and inspiring scenes; in other words, the opportunity of being brought face to face with Nature in hours of relaxation. While time cannot be taken to discuss these several points, it seems by no means unwarrantable to assume that there is not one of them in which America must yield to any country in Europe.

What shall be our criterion of judgment in our comparison of this average sentiment? Evidently not the individual expressions of this or that traveller. As many absurdities can perhaps be quoted from the Cockney abroad as from the Yankee. These are evidently types of just the class we are not discussing. Nor are the numbers, merely, of any nationality to be found in the season at the mountain and seaside resorts at home and abroad a safe basis of judgment, though far from valueless in the comparison. The Scottish Highlands, the Swiss valleys and glaciers, the Rhine, the south of France, Naples, are overrun with English and American

tourists. While no figures are at hand, I think the experience of all who have been there will bear out the statement, that it would be difficult to tell which nationality outnumbers the other in most of these places; and this, too, notwithstanding the fact that the one has the advantage over the other of a proximity nearer by an ocean's breadth. No one imagines that these itinerants of the two most prodigal of nations are all lovers of Nature. The majority of them are not; many of them are. With members of the latter class among our countrymen, our critic does not seem to have had the fortune to meet. He seems to know nothing, either, of the thousands upon thousands who annually go for shorter or longer periods to our own mountains, seashore, and rural districts, led, in a multitude of cases, not by love of fashion or hotel fare, but to settle quietly down in rustic dwellings, in the solitary "tent on the beach," or the rude camp at the mountain's base. Is this customary in "our old home" also?

But we are not forced to depend upon testimony of this sort. Happily we possess a literature of our own, a portrait of what is richest and most abundant in our deeper life as a people, which, for what it is and what it argues, is an irrefutable witness for us. Poets are rarely born into wholly insensible surroundings, and certainly the species is not perpetuated in an unsympathetic environment. When the sun goes up, the sternest cliffs must smile in its reflected beams. When the bright water plunges from the mossy cliff, the sleepiest old trunks about it in the forest must more or less echo its music. Just so do the hearts of a people respond to the poet's truth, and cheer him to new lays, while they themselves are elevated and refined.

America need not fear to compare her poets that have especially derived their inspiration from Nature with those of England herself that have written in the same department, especially when we consider the fact that the new country hardly rose to poetry until after the last high tide of English literature. Their inspiration has been no factitious one. The American poets have not reflected any conventional literary landscapes, but their own forests, mountains, sea-beat cliffs, and prairies. Indeed, if there is any one field in which

American writers may claim rank among the first for power and originality, it is in this department of Nature-poetry.

I know not how early this element first made its appearance in American literature, but in the same year in which Wordsworth produced "The Excursion," a youth of eighteen living in a rural town of Western Massachusetts wrote these familiar and pertinent words: —

"To him who in the love of Nature holds
Communion with her visible forms she speaks
A various language; for his gayer hours
She has a voice of gladness, and a smile
And eloquence of beauty, and she glides
Into his darker musings, with a mild
And healing sympathy, that steals away
Their sharpness, ere he is aware."

And then, after this declaration of faith, that grand symphony which lifts one so high above the dreariness and awfulness of mortal decay, and finds its climax in that passage of full Shaksperian grandeur and comprehensiveness: —

"The hills,
Rock-ribbed and ancient as the sun, — the vales
Stretching in pensive quietness between;
The venerable woods — rivers that move
In majesty, and the complaining brooks
That make the meadows green; and, poured round all,
Old Ocean's gray and melancholy waste, —
Are but the solemn decorations all
Of the great tomb of man."

Before all names of our native poets we must set that of Bryant, when this department of poetry is under consideration. It is astonishing to what an extent his muse sang of Nature, and not merely in a broad, general way, as in "Thanatopsis," but with a minuteness of detail which reveals an eye and soul truly and profoundly educated in the school of out-of-doors. It is hard to cite examples out of such abundance, but let one read his "Forest Hymn," "Inscription for the Entrance to a Wood," "The Hurricane," "The Fountain," "To the Water Fowl," "Green River," the introduction to "Monument Mountain," and say if the local color of the New England scenery, scenery with which the explorers of this

Club even are hardly more intimately familiar, is not rendered with a vivid truthfulness which marks the profound observer as well as the poet. It hardly needs his poem of "The Rivulet" to assure us that his inspiration was home-born, and not due to any transatlantic afflatus.

Time has been when an American would have esteemed it as much an unwarranted boldness as the Englishman a ridiculous presumption, for the former to put a native poet in comparison with the British laureate, who has struck out such powerful harmonies from this modern harp of Nature-poetry. Scarcely should I venture now to do so unsupported. But let speak for us a critic, himself a poet, who has compared Bryant with Wordsworth as a poet of Nature. Mr. R. H. Stoddard says of him: "He had no superior in this walk of poetic art, — it might almost be said no equal, for his descriptions are never inaccurate or redundant. 'The Excursion' is a tiresome poem, which contains several exquisite episodes. Mr. Bryant knew how to write exquisite episodes, and to omit the platitudes through which we reach them in other poets."

I have dwelt thus at length upon Bryant because, more than with any other of our poets, Nature is the source of his inspiration, and because with him she is portrayed for her own sake. His word-painting is "realistic" in the best sense of the word. Far less frequently than most poets does he employ her to mirror human sentiments, still less consider her as but thinly veiling an infinite, divine personality. In these particulars, especially the former, he differs markedly from that poet who has so sweetly sung the familiar scenery of our New Hampshire hills. In Whittier the sympathy with Nature is established by endowing her with human attributes and emotions. How plainly this is seen in the opening verses of his "Among the Hills"!

But it is quite out of the question, as well as apart from our purpose, to bring forward, even by name, the American poets who have given evidence of a profound appreciation of the grand and beautiful in Nature. It would be a list almost coextensive with that of all our writers of poetry and romance, and would contain some names not wholly unfamiliar beyond

the Atlantic, among the rest Emerson, Longfellow, our present minister to the court of St. James, Thoreau, Hawthorne, Whitman, and Joaquin Miller, certain of whom, indeed, are more highly appreciated in England than at home.

And what is attested by our literature is fully confirmed by our art. Certain striking facts appear even upon the most superficial consideration of this field. First, that within a period of fifteen or twenty years art in America has made great strides, and especially in the numbers of those who exercise it. Secondly, that it is in landscape in particular that their most excellent work is done. Thirdly, that, as in literature, the work of our artists is quite free of conventionality and plagiarism. Lastly, and explanatory of the preceding, it is our own natural scenery, with the attendant phenomena of our climate and atmosphere, that has furnished them their subjects.

The causes of this sudden efflorescence are not far to seek. The fact itself is eloquent with respect to the susceptibility of the Anglo-American to beauty, his native æsthetic capabilities. It confirms our statement that the sordidness, the *terre-à-terre*, of our practicality was the necessary result of our circumstances, while our country was still so new as to make its material development the natural working-point of all energy. Chief among the impulses to this sudden development must, of course, be reckoned the inspiration gained in foreign travel and by dwelling in an atmosphere where art is native. The scores that have studied abroad have become on their return foci of inspiration, and thus the flame has spread.

What shall we infer from the fact that landscape furnishes them their most frequent subject? Certainly this department of art has not the prestige in Europe to-day that it once enjoyed. The most popular ideals of the French school — and it is to Paris that the majority of our artists go to study — are the nude figure, or a semi-clad realism as hateful in painting as Zola in literature, which exaggerates the prominence of color as he the importunity of stench. Why do not our unsophisticated young countrymen yield to the influence of such examples and return to propagate these dubious ideals? Is it not the most natural inference that landscape is the

most sympathetic subject to these representatives of a young, æsthetically healthful people? The argument loses nothing of its force, if we allow that here, as elsewhere, "die Kunst geht nach Brod." We readily admit that this is not the highest field of art, that the soul of man is a nobler subject than the soul of Nature, so far as it is given to most of us to apprehend it; but we are not seeking to prove that America has produced great artists, but simply to show that her children are not incapable of a profound appreciation of and sympathy for those expressions of sublimity and beauty which their country presents to their eye and soul in such profusion.

Quite as wide of the fact as his inference as to American susceptibility — it seems now scarcely necessary to say it — is Mr. Allen's conception of the kind of natural beauty which appeals most strongly to the American: "Smiling landscape-gardening, and, as it seems to us, flat or dull cultivation," the treeless meadow! Is it not evident to any person at all familiar with the "comparatively small class" among our people that a more strikingly incorrect statement could not be made? Our poets and prose-writers teem with descriptions of mountain, forest, and sea, and these furnish the motives of our artists. If the prairie, even, is the theme, it is the sublimity of its vastness, or perchance the profusion of its brilliant flora, that inspires the poet. Thus, to quote again from Bryant: —

> "These are the gardens of the Desert, these
> The unshorn fields, boundless and beautiful,
> For which the speech of England has no name, —
> The Prairies. I behold them for the first,
> And my heart swells, while the dilated sight
> Takes in the encircling vastness. . . .
> Man hath no power in all this glorious work:
> The hand that built the firmament hath heaved
> And smoothed these verdant swells, and sown their slopes
> With herbage, planted them with island groves,
> And hedged them round with forests. Fitting floor
> For this magnificent temple of the sky —
> With flowers whose glory and whose multitude
> Rival the constellations! The great heavens
> Seem to stoop down upon the scene in love, —
> A nearer vault, and of a tenderer blue,
> Than that which bends above the eastern hills."

I venture to say that such are the impressions which would fill the soul of any somewhat cultivated American viewing the same scenes for the first time; but if this, or anything like this, most fully satisfies our national taste, how comes it that our summer travel is not to the prairies, or at least rural lowlands, rather than to the mountains and rock-bound coast?

It was very natural, perhaps, that Mr. Allen should have been surprised at the "unfeigned ecstasy" of his American companion. It is regrettable that he did not seek farther for its explanation. This American, he tells us, had just landed in England. Hence he was doubly ready to express his admiration of what might to a person quite familiar with a not particularly striking landscape seem "weary, stale, flat," if not unprofitable.

In the first place, land trodden once more after the little lifetime of a sea voyage has a strange charm, awakens in any but the most stolid a poetic emotion which would transfigure dulness itself, to say nothing of the fact that the heart of the American, except he be of the most "stalwart" patriotic type, warms towards the mother-country and all its scenes. Again, the American going to Europe expects to admire, perhaps even more than the wonders of Nature, the evidence of man's activity through a past that hardly exists for him save as related to that continent. Therefore Nature so perfectly reduced to subjection to man might easily awaken a kind of emotion. The kind and degree would be wholly dependent on the individual. I can conceive that it might even rise to ecstasy.

And here, however much might be added, we may be willing to rest our case. We have endeavored to show that, upon *a priori* grounds, there is no reason why we should not be as susceptible to the æsthetic emotions in the presence of grand and beautiful scenery as perhaps any nationality, by reason of our temperament, our surroundings, and the education of our circumstances. Secondly, to adduce in direct evidence the testimony of our almost universal custom of summer migration to grand and beautiful scenes, and the more telling, as more dignified, witness of an honorable lit-

erature and already wide-spread and promising art. These things we furnish as an offset to statements seemingly prompted by prejudice and supported by ambiguous illustrations.

Report of the Recording Secretary for 1880.

THE general prosperity which your Secretary had the pleasure to record in his last report has happily continued during the past year. The membership of the corporation has increased from 235, of whom two were life members, at the time of the last report, to 320, of whom five are life members, at the present time, being a gain of thirty-six per cent. The number of honorary and corresponding members remain unchanged, being respectively nine and twenty-eight.

There have been held during the year nine regular and two field meetings, the latter at Plymouth and at the Fabyan House, N. H. The Club acted in connection with the second, as escort to the American Association for the Advancement of Science, on the occasion of its excursion to the White Mountains at the close of its Boston meeting. Excursions have been made to Spot Pond and Mt. Monadnock, and, in connection with the field meetings, to Mts. Prospect, Holderness, and Moosilauke, to Mt. Willard and over Mt. Washington.

Another number of APPALACHIA has been published, and, thanks to the prosperous condition of our treasury, has been paid for without the aid of special subscription. It is hoped that hereafter at least one and perhaps two numbers may be issued regularly each year.

The library continues to increase, and through the exertions of our President and Corresponding Secretary a very important source of additions to it, which had not formerly received the attention it deserved, is being actively developed. I mean the exchange of our publications for those of other

societies whose objects are similar to our own, and whose ready and courteous recognition of us has been a compliment which we have but tardily reciprocated. It is hoped, however, that the relations now being established with these societies will not be again interrupted, and will be a source of pleasure and profit which will seem to them, as it certainly will be to us, in every way desirable to continue.

The membership of the Club is now reaching a point where continued existence and usefulness depend far less than formerly on the enthusiasm and continued exertions of a few of its original founders. Its position in the community is established and recognized, and its sphere of usefulness and plans of work, at first necessarily somewhat uncertain and tentative, have now become in great part well defined and settled. But far from being a reason why any member of the Club should consider such help as he may be able to give as of small consequence, this maturer condition should be recognized by the majority of members as affording them their especial opportunity; for the more settled and better organized the plans and work of the Club become, the better it can make use of the results, large and small, of such work as its members may find opportunity to do; and the greater the number of such contributions the better is the chance of making such combinations of them as can alone render any of them of permanent value. Moreover, the fact that many of those who were formerly among the most prolific contributors of material for the entertainment of our meetings, for publication, and for the advancement of our work are no longer able to give us so much of their time, makes it especially desirable that all who can do so should help, though by ever so little, in the work to be done.

Finally, in closing this last report, your Secretary wishes to thank the members of the Club for the consideration and forbearance which have made the burden of his official duties light and pleasant to carry, regretting only that he has been unable to give to those duties all the time and attention which might have been spent upon them with advantage to the interests of the Club; and he wishes to add the assurance, that although, for the present at least, unable to be so active

as formerly in the work of the Club, he will continue to be an interested member, and will always be glad to assist in any way possible.

Respectfully submitted,

J. B. HENCK, JR.,
Recording Secretary.

Report of the Corresponding Secretary for 1880.

THE first report of the Corresponding Secretary is of necessity a brief one, as the office was created and filled at the regular meeting of the Club in June last. As stated at the time of the election, the intention was to relieve the Secretary from a part of the labors of his office, enlarged as they had become by the rapid increase in our membership, and to place the official correspondence of the Club on a better footing by assigning that alone to the care of a special officer. The wisdom of this course is evident from the amount of time now occupied by each of the Secretaries in his duties, and from the fact that even yet a considerable amount of work remains to be undertaken.

The correspondence has been mostly of a routine nature, relating largely to APPALACHIA, to exchanges, and to membership. A welcome variety was furnished by an interesting letter from Mr. Warren Upham, concerning his geological work in Minnesota, which was read at the November meeting; and also by a letter from one of our honorary members, Prof. Edward Tuckerman, of Amherst, expressing a warm interest in the Club, and enclosing a donation, which will be noted in the Treasurer's report.

By the direction of the Council the last number of APPALACHIA was sent to each of our nine honorary members. It was thought best, also, to make an effort toward obtaining a more extended knowledge of, and recognition by, organizations similar to our own in foreign countries. For this purpose a selection was made of forty-one such societies in all the

countries of Europe, and to each was sent a copy of the last issue of APPALACHIA, together with the following circular letter: —

BOSTON, , 188 .

To the Secretary of the

MY DEAR SIR, — I send you by to-day's mail a copy of the last issue of APPALACHIA, the official publication of the Appalachian Mountain Club of Boston. From the Constitution, which I enclose, you may judge somewhat of the nature and objects of the Club. It is our desire to further the interests of geographical knowledge, in regard not only to our own country, but to others as well. The Council of the Club has, therefore, instructed me to send you this copy, thinking it might be of interest to your Society, and that an interchange of publications might prove a mutual satisfaction and benefit. We should be pleased to have an acknowledgment of this, addressed, "Appalachian Mountain Club, Boston, Mass., U. S. A."

Very respectfully yours,

R. F. CURTIS,

Corresponding Secretary.

As our American exchanges are comparatively few in number, and somewhat irregular, I would respectfully suggest that a similar effort be made to increase our relations in this direction. Constant familiarity with the doings of those who are interested in the same matters with ourselves will be a sure means of raising our own to a higher standard. It is earnestly hoped, therefore, that as many of our members as possible will avail themselves of such maps and publications as we have on hand, which can always be had on application to the Recording Secretary.

Respectfully submitted,

R. F. CURTIS,

Corresponding Secretary.

Treasurer's Report for 1880.

The receipts for the year ending Dec. 31, 1880, were as follows: —

From balance on hand Dec. 31, 1879			$105.50
" admission fees of 89 new members[1]	$178.00		
" assessments for 1880 from 166 members	332.00		
" assessments of previous years	24.00		
" assessments for 1881, in advance	4.00	$538.00	
" three payments for Life Membership, from Dr. Mary J. Safford, and Messrs. Edwin S. Balch and Henry P. Curtis		90.00	
" sales of Appalachia, by the publishers, in 1879	10.50		
" sales of Appalachia, by the Secretary and Treasurer, of various back numbers	18.05		
of bound copies of Vol. I.	31.50		
of Vol. II. No. 2	46.80		
of future numbers	3.50		
" sales of covers and binding for Vol. I. of Appalachia	6.55	116.90	
" donation by Mrs. H. E. Prentiss, of Bangor, Me., to the publication fund	6.90		
" donation by Prof. J. D. Dana, of New Haven, Conn., to the publication fund	5.00		
" donation by Prof. Edward Tuckerman, of Amherst, Mass., to the publication fund	20.00		
" donation by American Institute of Instruction in 1879, for signs for the Mt. Carrigain and Waterville path	12.00		
" donation by Miss M. F. Littlehale, for signs on the same path	3.00		
" donation by Joshua W. Davis, of Boston, for work of exploration and improvements	3.00		
" donation by Miss Ellen J. Baker for improvements	5.00		
" donation by 37 members and friends of the Club,[2] visitors at Campton, N. H., for building the Thornton and Warren path	31.00		
" donations by Messrs. James R. Carret and F. I. R. Stafford (balances of remittances)	.31	86.21	
" interest on investments		10.79	
Total net receipts for the year		$841.90	841.90
Total			$947.40

[1] Of this amount $68 was for the admission fees of 34 members elected in the latter half of 1880, who are thus exempt, under Art. XIII. of the By-laws, from the annual assessment of 1881.

[2] Mmes. S. C. Alford, S. C. Anthony, R. A. Bradford, T. Davis, M. T. Goddard, S. A. Hollis, E. A. Parker, H. J. Price, L. D. Pychowska, Schneider, and Stebbins, Misses A. Bridge, E. W. Cook, Davis, E. G. Lockling, Pychowska, Schneider, M. L. Vose, the "W. W. Club," and Messrs. E. H. Capen, E. B. Cook, T. Davis, C. E. Fay, A. Gunnison, G. Hyde, A. E. Kittredge, C. H. Leonard, C. Lyon, I. D. Perkins, E. C. Pickering, J. N. Pychowska, E. C. Sweetser, H. S. Twombly, S. M. Vose, S. F. Whitney, and B. W. Wilson.

The expenses were as follows : —

Paid for postage, express, stationery, &c.			$77.50
" for investment in Suffolk Savings Bank (permanent fund from life-memberships received in 1880)			90.00
" printing and binding of Appalachia, Vol. II. No. 2[1]	$240.85		
" for maps for the same number . .	49.10	$289.95	
" for binding and covers for bound copies of Vol. I.		28.18	318.13
" for printing and binding by-laws and list of members		15.40	
" for miscellaneous printing of notices and circulars,		93.27	108.67
" for expenses of the Topographical Department .			19.00
" for Improvements, viz : —			
Cutting and marking paths on Mt. Adams and Mt. Willey		14.50	
Cutting and marking Thornton-Warren path		53.25	
Cutting and marking on the Mt. Carrigain and Waterville path		3.00	
Boards and paint		1.85	72.60
Total expenses			$685.90

Balance on hand Dec. 31, 1880 : —

On deposit in the Suffolk Savings Bank	$4.66	
" " Cambridge Savings Bank . . .	250.00	
Cash on hand	6.84	261.50
Total		$947.40

The Treasurer takes pleasure in reporting as above a gratifying, though a moderate, increase in the receipts over those of last year ; the total receipts being $842 this year, as against $802 for 1879. The receipts from admission fees of new members, however, are $30 greater, and from assessments of old members are $60 greater than in 1879 ; being an increase of $90 from fees and assessments.

Herewith is appended a connected view of the receipts and expenses of the Club for each of the five years since its organization.

[1] For the total cost of the number, add $7.50, expended for maps in 1879, making $297.45 total cost.

STATEMENT OF RECEIPTS FOR FIRST FIVE YEARS.

Year.	FROM MEMBERSHIPS.				FROM SALES OF APPALACHIA.			From Interest.	From Donations.[2]	From Life Memberships.	Total.
	Admission Fees.	Yearly Assessments.	Back Assessments.	Total.[1]	By Sec. and Treas.	By Publishers.	Total.[1]				
1876	252.00			252.00	24.00	19.00	43.00				295.00
1877	52.00	248.00	12.00	312.00	74 00	24.00	98.00				410.00
1878	76.00	226.00	16.00	318.00	48.00	28.00	76.00		43.00	60.00	497.00
1879	148.00	260.00	40.00	448.00	119.00	11.00	130.00	2.00	222.00		802.00
1880	178.00	336.00	24.00	538.00	106.00	11.00	117.00	11.00	86.00	90.00	842.00
Tot'l	706.00	1070.00	92.00	1868.00	371.00	93.00	464.00	13.00	351.00	150.00	2846.00

STATEMENT OF EXPENSES FOR FIRST FIVE YEARS.

Year.	Permanent Fund.	Postage, Stationery, etc.	Miscellaneous Printing.	FOR APPALACHIA.			Topographical Department.	Art Department.	Improvements.	Total.
				Printing.	Maps.	Total.[1]				
1876		36.00	74.00	(1) 106.00	35.00	141.00			15.00	266 00
1877		39.00	84.00	(2) 115.00	40.00	155.00		13.00		500.00
				(3) 157.00	52.00	209.00				
1878		84.00	161.00	(4) 165.00	35.00	200.00	2.00	53.00	20.00	520.00
1879	60.00	66.00	96.00	18.00		18.00	19.00		159.00	612.00
				(5) 171.00	15.00	186.00				
					(6)8.00	8.00				
				28.00		28.00				
1880	90.00	77.00	109.00	(6) 241.00	49.00	290.00	19.00		73.00	686.00
Tot'l	150.00	302.00	524.00	1001.00	234.00	1235.00	40.00	66.00	267.00	2584.00
Balance now on hand										262.00
										$2846.00

[1] The figures in this column are to be omitted in adding up for the last column.

[2] Owing to the fact that the early donations to the Club were expended by the several Councillors, without being entered on the Treasurer's books, the above statement does not do justice to our early benefactors. In 1876, the Club were indebted to Mrs. Jared Sparks for a donation of $30 towards the work of improvements on Carter Dome and the Great Range; also to the proprietors of the hotels in the neighborhood of Carter Notch, for assistance in the same work. In 1878, the Club were again indebted to the generosity of Mrs. Sparks for the gift of $45 with which to construct a topographical camera.

The principal of the permanent fund has increased to $150; and the fund, with accumulated interest, now amounts to $154.66. The advantage to the Club from life-memberships is that at four per cent interest the Club will receive an income of $1.20 a year perpetually from each life-member, which is as good as $2.00 a year now, with all the risks from fluctuating membership. The advantage to the life-members is that they are forever free from the annual annoyance of assessments, and are sure of their position in the Club without thought or effort. Also, at the present and probable rates of safe investment, our members cannot in any other way pay their assessments so cheaply. In order to give permanent evidence of this perpetual membership, I would recommend that the names of life-members should be designated as such in our annual catalogue, and that a more formal voucher should be given them for the payment than our ordinary small receipt.

The policy of binding up the back volumes of APPALACHIA for sale has proved eminently successful; it has already much more than paid us for the outlay, and it is to be hoped it will always be continued.

Our chief expenditure still continues to be for APPALACHIA. Our receipts from its sales, however, are by no means in proportion to the outlay. The last number (Vol. II. No. 2), cost us $297, exclusive of mailing and postage. Our receipts from sales of that number, so far, are only $47, with less than $20 still to be paid by the subscribers; making our gross receipts from it not over $67, or a deficit of $230 on this one number.

We have a list of about 120 subscribers to APPALACHIA, of whom less than 100 are members of the Club. Very many of our oldest and most active members are not regular subscribers. We need a concerted and vigorous effort on the part of all our members to call in subscribers, both from within and without the Club. If this be undertaken in earnest, I have no doubt we can double, and even treble, our subscription list.

Respectfully submitted,

CHARLES WM. FOLSOM, *Treasurer.*

Reports of the Councillors for the Autumn of 1880.

Natural History.

BY J. H. HUNTINGTON.

ALTHOUGH the workers in Natural History during the last summer were not very numerous, some important work was nevertheless accomplished.

Mrs. L. D. Pychowska has continued her study of the ferns in the vicinity of Campton, N. H., with the same scrupulous fidelity as in previous seasons, and has increased the list published with my last autumn report (p. 158) by the following additions: —

Aspidium Goldianum (found at Plymouth), *Aspidium Boottii*, and *Cystopteris fragilis*. [The species called *Botrychium simplex* in the former list is found to be *B. matricariaefolium*.]

From the southern portion of the Appalachian field I am able to present an interesting communication from Prof. J. W. Chickering, Jr., of Washington, D. C., a corresponding member of the Club, in regard to the botany of that most attractive region, Roan Mountain, N. C.

Prof. C. E. Hamlin continued his work on Mt. Katahdin. He spent two weeks travelling over the mountain in every direction, so that now there is no portion of our wild northern country of which we have so thorough a knowledge, both as regards topography and geology.

The finding of another boulder on the top of Mt. Washington, by Prof. C. H. Hitchcock, adds confirmation to the theory that ice once covered that noted summit.

My own observations have extended over a very large area, I having travelled in twenty-two states and five territories of the United States, one state of Mexico, and two of the British Provinces. At some future time I may make some of the points of interest visited the subject of a special paper.

NOTES ON ROAN MOUNTAIN, NORTH CAROLINA. BY J. W. CHICKERING, JR.

A RESIDENCE on this mountain from June 25th through July and August, 1880, has furnished data for some notes botanical, meteorological, and general, that may be of interest to Appalachians, especially as indicating the contrast between the northern and the southern summits of the great Appalachian chain.

The mean of barometrical observations for the time gave the height of the summit as 6,391 feet. The hotel stands about 100 feet below. The top instead of being, as in the higher of our New England peaks, a mass of barren rock or weather-worn boulders for the upper 1,000 feet, is a smooth grassy slope of 1,000 acres, called a "bald" (the soil a foot or more deep, and as rich and black as a Western prairie), with rocky precipices at either end, rising 80 to 100 feet higher, but plentifully covered with vegetation.

The turf is of a most vivid green, even in August, and dotted with clumps of *Alnus viridis* (mountain alder) and *Rhododendron Catawbiense*, and bordered by *Abies Fraseri*, which extends down the mountain for perhaps 500 feet.

At the lower limit of the *Abies* we come to a series of slopes, or plateaus, covered with a growth of *Cratægus tomentosa*, var. *punctata* (thorn-bush), dwarf *Betula excelsa* (yellow birch), and *Pyrus Americana* (mountain ash), looking at a little distance precisely like an old orchard rather neglected.

At an altitude of 3,000 to 4,000 feet are found most magnificent specimens of *Castanea vesca* (chestnut), one measuring 24 feet in circumference, and hundreds from 5 to 7 feet in diameter, and running as straight as pines, 70 feet without a limb ; *Acer saccharinum* (sugar maple) nearly as large ; *Tilia Americana* (linden) ; *Magnolia acuminata* and *Tulipifera* (cucumber and tulip trees) ; *Æsculus flava* (buckeye) ; *Prunus serotina* (black cherry), one measuring 19 feet in circumference, and probably 70 feet without a limb; and many other trees of giant size.

The most conspicuous plants are *Verbesina Siegesbeckia*, around the base of the mountain, and *Eupatorium ageratoides*, each of them covering many hundreds of acres.

Cimicifuga racemosa and *Americana* are also very abundant, blossoming about a month apart, the latter succeeding the former.

The annexed lists give first those plants peculiar to the southern Appalachians, and then those found elsewhere, of which not a few belong to the White Mountains.

The climate is marvellously uniform to one accustomed to the sudden changes of the New England mountains. During nine weeks the mercury reached 75° (Fahr.) but once, and 70° but seven times. One morning it stood at 45°, and only three times below 50°. The average daily variation, six days out of the week, would be covered by 54° to 65°. A more

perfect climate for the botanist or the valetudinarian could hardly be imagined. Roaring fires were needed morning and evening, while the rest of the day the temperature was exactly fitted to mountain climbing, which the bracing air rendered easy and unfatiguing.

The barometrical uniformity was not less marked. During two months the average barometrical reading being a little less than 24 inches, while the extremes were 24.19 and 23.87, or a little less than a third of an inch.

Flora found on Roan Mountain, July–August, 1880, not common farther north.

Thalictrum clavatum.
Trautvetteria palmata.
Delphinium exaltatum.
Aconitum reclinatum.
Cimicifuga Americana.
Magnolia Fraseri, fr.
Diphylleia cymosa, fr.
Cardamine Clematitis, fr.
Arenaria glabra.
Paronychia argyrocoma.
Geum radiatum.
Geum geniculatum.
Saxifraga erosa.
Saxifraga Careyana.
Saxifraga leucanthemifolia.
Heuchera villosa.
Astilbe decandra.
Sedum Rhodiola.
Œnothera glauca.
Angelica Curtisii.
Ligusticum actæifolium.
Thaspium pinnatifidum.
Houstonia serpyllifolia.
Houstonia purpurea, v. montana.
Aster Curtisii.
Nabalus Roanensis, n. sp.
Cynthia Dandelion, v. montana.
Solidago spithamæa.
Solidago glomerata.
Solidago Curtisii.
Solidago monticola.
Solidago pubens.
Vaccinium erythrocarpum.
Vaccinium Constablæi.
Oxydendron arboreum.
Menziesia globularis.
Clethra acuminata.
Leucothoe recurva.
Leucothoe Catesbæi.
Leiophyllum buxifolium, v. prostratum.
Azalea calendulacea.
Rhododendron Catawbiense.
Galax aphylla.
Ilex monticola.
Campanula divaricata.
Blephilia hirsuta.
Pycnanthemum montanum.
Chelone Lyoni.
Cuscuta rostrata.
Asarum Virginicum.
Arisæma polymorphum.
Lilium Grayi.
Veratrum parviflorum.
Danthonia compressa.
Agrostis rupestris.
Carex æstivalis.
Carex juncea.
Lycopodium Selago.
Abies Fraseri.
Helianthus microcephalus.
Euphorbia Lathyris.
Liatus spicata.
Cacalia reniformis.
Rudbeckia rupestris, n. sp.
Asplenium parvulum.

Plants occurring on Roan Mountain, N. C., common farther north.

Anemone nemorosa.
Viola Canadensis.
Silene stellata.
Silene Virginica.
Rubus odoratus.
Ribes lacustre.
Ribes prostratum.
Tiarella cordifolia.
Sedum telephioides.
Lonicera ciliata.

Galium latifolium.
Liatris spicata.
Eupatorium ageratoides.
Aster corymbosus.
Aster acuminatus.
Solidago Boottii.
Solidago patula.
Helianthus atrorubens.
Verbesina Sigesbeckia.
Cirsium muticum.
Nabalus albus.
Nabalus Fraseri.
Pentstemon laevigatus.
Gerardia quercifolia.
Collinsonia Canadensis.
Scrophularia nodosa.
Monarda didyma.
Monarda fistulosa.
Lophanthus scrophulariæfolius.
Physostegia Virginiana.
Scutellaria versicolor.
Stachys palustris v. aspera.
Castilleia coccinea.
Aristolochia Sipho.
Alnus viridis.
Habenaria orbiculata.
Habenaria Hookeri.
Habenaria psycodes.
Habenaria tridentata.
Listera convallarioides.
Veratrum viride.
Smilacina racemosa.
Allium cernuum.
Allium tricoccum.
Lilium Canadense.
Lilium superbum.
Melanthium Virginicum.
Prosartes lanuginosa.
Corallorhiza innata.
Carex debilis.
Carex digitalis.
Carex gynandra.
Carex polytrichoides.
Carex retrocurva.
Agrostis perennans.
Bromus ciliatus.
Festuca nutans.
Poa annua.
Poa compressa.
Asplenium filix-fœmina.
Lycopodium lucidulum.

Reports of the Councillors for the Autumn of 1880.

Topography.

BY WILLIAM H. NILES.

THE limitation of the service of the Councillors to three consecutive years in the same department (By-Laws, Art. V.) prevented the reëlection of Mr. J. Rayner Edmands as Councillor of this department. Nevertheless, the Club is the recipient of his continued and valuable services. As much that has been accomplished in this department during the year has been done by him, or under his direction, the Councillor has requested Mr. Edmands to make a statement of the results obtained, and he has kindly furnished the following: —

"The character of the summer's topographical work was

largely influenced by the occupation of Mt. Washington by the United States Coast and Geodetic Survey. In June a call was issued for those who would undertake to heliotrope toward Mt. Washington from points which would otherwise remain unobserved. The response was gratifying; but all offers of this nature for July had to be declined, on account of delay in the completion of the observing tower on Mt. Washington. After the middle of August, however, useful heliotroping was done.

"The writer had planned to occupy a series of points with a Casella three-inch transit early in the season, and to heliotrope from many of them to Mt. Washington. Although the heliotroping had to be abandoned for the reason already stated, yet angles were measured at the following stations: Chocorua (twice), Prospect (in Holderness), Tecumseh, Morgan, Weetamoo, Wiers (cupola of new hotel), Wolfboro' (cupola of Pavilion House), S. Moat, N. Moat (twice), S. Doublehead, N. Doublehead, Carrigain, Tremont, Langdon, Chandler's Ridge, Boott's Spur, and Monroe. Assistance in this was obtained from various members in companionship, in recording, in identifying, and (from Prof. E. C. Pickering) in actual observation. We are indebted to Professor Quimby for his readiness, during hours when the more important observations cannot be taken, to observe minor points to a greater extent than the object of his survey would render necessary. His instructions for Mt. Washington, fortunately, involved the observation of well-defined distant summits. Much of this work was done in September with the assistance of the writer, who also observed many points in the immediate neighborhood of the summit of Mt. Washington and adjacent members of the group, and made some progress on the profile.

"Prof. G. Lanza did some topographical work in the vicinity of Andover, Me. His profile from Whitecap (not Bear River Whitecap nor Sunday River Whitecap) is given in Plate VII., on the reduced scale of four degrees to the centimeter.

"The topographical camera belonging to the Club was used in June and July by the White Mountain Club of Portland; in August, in the vicinity of Andover, Me.; in Sep-

tember, on Mt. Washington; and in October, by the Field Club connected with the Johns Hopkins University, of Baltimore."

The Councillor has made some observations upon the orographic relations of the mountains about Waterville, N. H., with the hope of connecting them with other observations looking to a more natural classification of the mountains into ranges and groups.

Reports of the Councillors for the Autumn of 1880.

Exploration.

BY W. H. PICKERING.

CONSIDERABLE activity has been manifested in the Department of Exploration during the past summer. Of the four regions outside of the White Mountains proper, to which attention was called in the spring report, two — the Grafton Notch and Katahdin regions — have been explored, and reports handed in, one of which appears in this number, p. 287.

Three of the mountains suggested for exploration have been visited, and another of the great ravines of the Mt. Washington range has been traversed.

In APPALACHIA, Vol. II. p. 182, there was printed a list of the more important of the less-visited peaks of the White Mountains, with references to articles which have appeared in our publication concerning certain of them. This list is here continued, a few typographical errors being corrected.

TABLE OF THE LESS-VISITED PEAKS OF THE WHITE MOUNTAINS (*Continued.*)

Name.	Elevation in Feet.	Reference.
Ingalls	3,500	Appalachia, II. p. 287.
Baldcap	3,000	" " p. 121.
Shelburne Moriah (Bald)	4,400	
Imp	4,000	

Name.	Elevation in Feet.	Reference.
Carter	4,700	
Carter Dome	4,830	Appalachia, I. p. 76.
Wildcat	4,350	
Royce	2,600	
Rocky Branch Ridge	3,000–5,000	Appalachia, II. p. 288.
Montalban Ridge . .	4,000–5,000	
Parker	3,300	
Webster	4,000	Appalachia, I. p. 121.
Nancy	3,800	
Tremont	3,400	Appalachia, I. p. 124; II. p. 282.
Silver Spring	3,000	" II. p. 282.
Bear	3,000	
Twin, North	5,000	
Twin, South	5,000	
Hale	3,400	
Hitchcock	3,600	Appalachia, I. p. 252.
Huntington	3,800	
Scar Ridge	3,820	Appalachia, I. p. 247.
Loon Pond	2,900	" II. p. 284.
Haystack	4,500	
Blue Ridge	3,300	
Waternomee	3,000	
Cushman	3,300	
Kineo	3,400	Appalachia, II. p. 166.

It will be seen that there are still sixteen White Mountain summits of considerable importance, of which we know but little, and it is hoped that by the autumn of 1881 the number will be still further reduced.

MTS. SILVER SPRING AND TREMONT. BY J. RAYNER EDMANDS.

THE col connecting Mt. Tremont (O 6.) with Mt. Silver Spring (O 5.) is hardly high enough to induce one to combine the two mountains in a single excursion; but the means thus afforded for carrying out certain topographical designs, and the fact that it was thought practicable by Mr. H. M. Rideout, of Bartlett, led the writer to undertake it, August 11, 1880. Mr. Rideout accompanied, and wielded the axe on Mt. Silver Spring. His intimate knowledge of the country proved a valuable assistance.

The whole excursion occupied thirteen hours off the carriage-roads, including two hours and twenty minutes on the summit of Silver Spring, an equal interval at the summit of Tremont, twenty minutes for dinner,

fifteen minutes for supper, and thirty minutes at the spring (after an unsuccessful fight against "jackstraws"), not to mention smaller rests. The small Casella transit was carried, and a series of angles taken at the summit of Tremont.

In giving directions for the benefit of others, a suggestion of Prof. E. C. Pickering's has been adopted. The actual times made on this occasion are ignored, and the writer's estimate is given for the time reasonably to be allowed to the several portions of the route, over and above a proper amount of rest. The estimates imply active exercise, but without hurry; and they imply that rest will be taken when desirable.[1]

Take road S. W. from Upper Bartlett (P. & O. R. R. station), 2 kilometers (1¼ mile) to house and mill on R.; cross bridge at dam, and take the "road through Swift River Notch," direction W. In 3 min. take L.; in 7 min. more take R.; in 10 min. more pass log-cabin on R., take L., cross and recross brook. In 10 min. reach brook flowing S. E. Do not cross bridge, but seek logging-road to R. The beginning was found obstructed with wood-cutters' rubbish. Allow 10 min. to penetrate this and find the road.

General direction N. W. Smooth footing and easy grade, but through black cherry bushes 3 meters (10 feet) high. In 10 min. a rude bridge where a logging-road enters on R., and in 15 or 20 more a bridge over brook (found nearly dry) flowing N. E. This rises on N. E. slope of Silver Spring, and empties into Albany brook, about 250 meters (50 rods) below the mill mentioned above. In 15 min. reach head of logging-road, bear a little to L., ascend the slope directly, and (5 min.) gain the ridge between the main summit of Silver Spring (5.1) and 5.2. Summits visible through trees W. S. W. and E. N. E. respectively. Ascend the ridge (W.) by easy grade 10 min. and take the steep slope in zigzags (15 min.) to the summit. For comfort, allow for resting during the last.

Summit wooded, except narrow outlook toward Mt. Washington, cut on this occasion. About 15 meters (50 feet) from the summit toward Tripyramid is a ledge, of nearly the same elevation, with sheer descent on three sides. If cleared, Silver Spring would furnish an attractive view, easily accessible from Upper Bartlett.

In continuing to Tremont, pass N. of the ledge just alluded to, and keep to R. of the crest of the westerly ridge, to avoid an error toward L. In 45 min. reach an open place with brakes (no water found) in the saddle. A direct ascent from here would bring one under the steep

[1] To properly reason from an actual time record, one should know the activity and endurance of the climber, the relative effort expended on the particular occasion, the time spent in motion, and any causes of delay which one following him might avoid, together with the number and the prevailing length of the rests. The importance of the rests is due to the fact that they influence the net moving time in which the same climber can do the given work. But *he* can consider all these circumstances in making the estimate proposed, and give the result in concise form.

S. E. face of Tremont. Therefore bear to R. of this, and take the slope obliquely. The summit (6.1) bears three knolls, the middle being the highest. Passing the first and second knolls, gain the crest of the ridge between the third and the second, and then turn L. to latter. This is necessary in order to keep within the old growth, and thus avoid the rampart of jackstraws around the foot of the bare ledges. From saddle to summit is about 1¼ hr. On the way, at the base of the highest knoll, in the woods, just below the jackstraws, there was found a very welcome spring, far under an overhanging rock.

Mt. Tremont has been described by Mr. J. B. Henck, Jr.[1] The direct descent (2 hrs. or more) to the Saco River road is that taken by him. Advantage may be gained by following the crests of certain mounds running beside the ravines.

Loon Pond Mountain. By Mrs. Lucia D. Pychowska.

Loon Pond Mountain lies between Scar Ridge and the valley of the East Branch of the Pemigewasset. It has been burnt over several times, and its upper portion is covered with the low growth of deciduous trees usually following such catastrophes among the mountains of New Hampshire. Its southern side is scarred with bare, rocky ledges, and these two causes give to it a hue so much lighter than that of the surrounding eminences, that it is a noticeable object from many points, far and near. This fact, showing that an extended view must be attainable from its summit, joined to the reputation for loveliness of situation pertaining to the two lakes, induced our party to visit the place.

September 21, 1880, Mr. E. B. Cook and five ladies left Blair's, in Campton, for Pollards', near the mouth of the East Branch, — the ladies in mountain-wagon, Mr. Cook on foot. Here we passed the night. The weather on the morning of the 22d was lowering, but a cold northwest wind promised to lift the clouds somewhat. When we asked for a guide, Mr. Dura P. Pollard said he would gladly go with us, but we might find some difficulty in getting over the East Branch, as the river was considerably swollen by the recent rains. In case we could not cross, we should have to go to Sharon, three miles down the valley, and ascend from there. This had not made part of our plan, so we determined to try the crossing at the Pollard place. The lakes were said to be three miles from the house, and the top of the mountain a mile farther on, the trail to the lakes indistinct, and no trail at all to the summit.

Crossing the intervale, the river was soon reached, and we ladies looked in dismay at the broad, rushing stream. The sunlit, forest-clad banks, and the clear, sparkling water dancing about the great granite boulders, would have made a charming sketch, if time had not failed our artist.

[1] Appalachia, Vol. I. p. 124.

Mr. Pollard felled two small birches, and laid the trunks across from rock to rock over the current where swiftest and deepest. A supply of stout walking-sticks was also speedily cut, and, thus equipped, we started on the watery passage. At the end of the frail bridge there was nothing to be done except to continue on through the stream, choosing, in addition to the few dry stones, such as were not more than six inches under water. Although totally unprepared for such an experience, our ladies marched cheerily through, and soon reached dry land again, with nothing worse than wet feet, which speedily dried on the upward stretch through the beautiful forest of maple, beech, birch, and hemlock, which covers the northern slope of the mountain. The undergrowth is of the ubiquitous hobble-bush (*Viburnum lantanoides*), and the American yew (*Taxus Canadensis*).

There were blazes on the trees, and the trail was indistinctly visible among the fallen leaves, until the top level was reached, when it nearly disappeared among the ledges and the low bushes which here replace the noble forest trees.

A slight détour took us to a famous ledge of milky quartz, several feet in height, and of considerable length. This passed, we soon came out upon the larger lake, a beautiful sheet of water, covering about fifty acres of surface, quite deep, very clear, still holding trout, and bordered by wooded or rocky shores. Sheep-laurel (*Kalmia angustifolia*), leather-leaf (*Cassandra calyculata*), Labrador tea (*Ledum latifolium*), pitcher-plant (*Sarracenia purpurea*), and dwarf cornel (*Cornus Canadensis*) grow in abundance round the basin. Under the high rocks at the easterly end we found the pretty fern, *Cystopteris fragilis*.

To the southeast of the lake rise three rocky heads inviting to a farther climb. From the first and lowest summit we had a charming view of the lakes, — the smaller one, a rock-set gem, apparently a little lower down than the larger. Over them, on the other side of the valley of the East Branch, towered Mts. Cannon, Lafayette, Liberty, and Flume, all clear and dark against a cloudy sky.

The two succeeding heads were divided from each other by shallow ravines, and the way lay through low trees, bushes, broken rocks, fallen timber, with every now and then a diversion in the shape of a slope of sliding, decayed rock, similar to that of the slide on Tripyramid. The extreme southern head reached, proved to be made of this friable material, and afforded coasting privileges to such as cared to enjoy them. The larger ledges are of a firmer granitic rock, much worn and rounded by the action of former glaciers and more recent wintry weather. Great boulders are scattered about in unexpected places, and the higher rocks are split into picturesque blocks and shafts.

The mouth of the East Branch is given as 712 feet above the sea level. Mr. Pollard's house is a few feet higher, say 750 feet above tide water. Loon Pond is presumed to be about 2,000 feet above the valley, and the highest summit 200 feet above the pond; making an aggregate of 2,950

feet for the entire height of Loon Pond Mountain. This may be so, but judging merely from the impression produced by the one ascent, the writer would be inclined to take off a couple of hundred feet from the height of the lake above the valley, and add one or two hundred feet to the height of the summit above the lake.

After a short enjoyment of the charming view, a plunge through the scrubby maze of the burnt district took us over the mile down to the lake, and thence, by an easier passage, we made the river-bank once more. There our attentive guide led us over the broad stream to the house, where dry shoes and an excellent dinner awaited us.

We had been from half-past eight in the morning until half-past two P.M. making the tour of the lakes and the summits, the distance supposed to be only eight miles, but the way beyond the lakes decidedly rough and entangled. A little blazing, cutting out of impediments, and laying some guide-stones on ledges, would make an easy and readily found pathway.

Exploration of a Gorge on Mt. Lincoln. By C. E. Fay.

In making the ascent of Mt. Lafayette, on the 12th of September, 1880, Professor Cross and myself, during our halt for lunch just beyond the lakes, noticed, as we looked across the broad intervening ravine, a narrow, dark shadow running for some distance down the precipitous northerly slope of the great west spur of Mt. Lincoln. It began perhaps a hundred feet, measured on a vertical, below the crest, and somewhat to the right of a noticeable protuberance of rock on the ridge-line, — just to the right also of the upper part of the broad expanse of precipitous ledges that form so prominent a feature of the northwest slope of this mountain. It extended perhaps half-way down the remaining distance to the ravine bottom. A good opera-glass failing to determine its nature, we decided to explore it, and to return to the Profile House by the untried way of the ravine. This plan we successfully accomplished.

We found the mysterious shadow to be caused by a sunless gorge, which, if not so remarkable a natural feature as we had hoped to find, seems to us worthy of a visit from such sure-footed pedestrians as should find themselves on Mt. Lincoln. A half-hour would afford time to obtain a general idea of its character and return to the summit, but for a thorough exploration (such as we were unable to make) one should be provided with a long rope, and allow more than an hour. Time will also be saved if, when ascending Lafayette, one carefully notes the point on the crest-line below which the shadow begins. Descending too soon, we were forced to make our way several hundred feet through dense scrub growing on a treacherous and precipitous slope.

Reaching finally the proper point, we found a very steep, irregular, rocky gully, down which, during rains, a considerable quantity of water doubtless finds its way to the brook below, and where the drainings of the previous day's rain were still trickling. We undertook to make our way down by it, but found this by no means an easy task. At one point our simplest course was to remove some large stones that had lodged in a broad crevice which began abruptly at the base of a steep rock, and to let ourselves down through the hole thus made to its steeply inclined bottom some six or seven feet below, thence out under the sky again. A few rods farther brought us to a place beyond which it seemed imprudent to venture without proper appliances. From here, so far as we could discover, there was an almost vertical descent of perhaps seventy-five feet. Much caution was requisite in abandoning our chosen path, as it was necessary to take advantage of a few widely separated projections of the rocky wall as foot-holds, and to choose discreetly upon which of the shrubs rooted in the wet, mossy soil we would rely for our grasp. On reaching higher growth, we made our way rapidly down to the rocky bed of the main stream.

We had intended to make our way to the lower end of the gully, and investigate it from below, but our time was quite too short. We had left the summit of Lincoln at 4.45; it was now, at least, 5.30, and this stream must be followed to its end, if possible, before dark. With our most earnest endeavors, this did not prove possible. The brook offered no essential variation from the usual type in these regions, not even in its quality of interminableness. In the upper portion, where the descent of the stream was rapid, our progress was necessarily slow over the great water-worn fragments of rock that filled its bed, and the slippery coating of moss which grew in profusion in the smoother ledgy portion of its course.

Fortunately, darkness did not overtake us until we had passed the worst portion of our way, and were within perhaps a quarter of a mile of the stage-road. From here on, unable to discern each other, or what lay at our feet, we proceeded, feeling our way foot by foot, cautiously discovering windfalls with our shins, until our patience was rewarded at the end of an hour by suddenly coming out upon the highway, at 8.05. Our course had been easily kept by remaining always within hearing of the brook on our right. We were surprised to find how practically useless the low rising moon was in lighting our way. Even where its rays fell into the woods about us, they served only to reveal the trunks of the trees above our heads.

MOUNT INGALLS. BY MISS MARIAN M. PYCHOWSKA.

THE high mountain in the township of Success, N. H., and near the Maine line, in whose ravines the Ingalls River rises, is named on the State map "Ingalls Mt." In 1872, not having at that time seen this name, and being unable to obtain any except the vague designation of "Green Mt." from the farmers of the Shelburne Valley, our party called the peak, for our own convenience, "Mt. Success."

We accomplished our first ascent in August, 1872, by way of Mill Brook and over the great southern shoulder, but the route by which we returned, through the Ingalls Valley, is much more to be recommended. The wood-road on the west side of the Ingalls River is quite good as far as the logging-camp; that is, for about four miles. It crosses the river's west branch just below this point. One may now turn to the left, following an overgrown road along the inner slope of the eastern shoulder for about two miles. From the gully in which this road ends, to the place on the stream where the old blazed line begins, may be a half mile. Mr. E. B. Cook connected these points by blazes of his own, besides renewing some of the old ones on the line above. This line turns steeply up the western side of the ravine, and, quite high on this shoulder, it forks, the division being found marked on a tree by surveyor's signs. One branch keeps on over the shoulder, the other, turning abruptly to the right, leads one through the high spruce growth for about a mile, when, a narrow belt of stunted trees being passed, the bare top is gained. This top is a ridge perhaps a third of a mile long. Until the summer of 1876 the gray rocks were clothed almost entirely with a carpet of deep, wet moss, and the little gullies were filled with low spruce thickets in which the deer-paths were useful; but in that year the fire of the camping-party, though carefully drawn together, and scarcely smouldering when left, played traitor, and, working its way through the moss, blackened about one-third of the beautiful summit.

In a wet season, water can be squeezed from the moss in many places, but the best found by the party was a spring a little below and to the east of the highest point of the southerly end of the ridge.

The altitude of Mt. Ingalls, as given by the aneroid, is 3,544 feet.

As well as the members of the party can now recall them, the main points of the outlook are as follows: Across the Ingalls Valley is the long ridge of Robinson's Peak; beyond the Androscoggin are Caribou, with the shining expanse of Sebago Lake and its attendant ponds over it, — Pleasant, Royce, Baldface, the unmistakable horn of Chocorua, and other distant mountains in that direction; then, the Carter and Moriah range, the Great Range, Cherry Mt., Baldcap and Hayes, the Pilots, etc., and the Percy Peaks. Over the Success wilderness, in the middle of which lies Burnside Pond, may be seen portions of the Rangeley Lakes, with their neighboring mountains. Most fascinating of all are the near, picturesque heads of Goose-Eye and the great back of Speckled Mt. (N.), sloping down to the Mahoosuc Notch. To the northeast rise the distant sharp peaks toward Phillips.

THE BOULDER SOUTHEAST OF BOOTT'S SPUR. BY W. S. FENOLLOSA.[1]

PROBABLY many persons who have taken the stage-ride from Jackson to the Glen have noticed a huge boulder, so situated upon one of the southern ridges of Mt. Washington as to stand out sharply against the sky during two or three miles of the journey. It rests upon the ridge at a point where the slope is quite steep, and looks as if a slight force would be sufficient to detach it and send it crashing down through the forests to the valley below. This boulder was visited in July, 1876, by Messrs. E. F. Fenollosa and R. B. Whitridge, and the writer. The ridge on which it is situated is the second one south of Boott's Spur, and is separated from the southern wall of the Gulf of Slides by a smaller ravine which has no name. It is by this smaller ravine that the best approach to the boulder is afforded. To enter it, one should take the first brook south of the highest point of the stage-road in Pinkham Notch, or Spruce Hill, as it is called by the drivers. Ascending by this brook for about half a mile, some very pretty cascades will be found at a point where the brook falls two or three hundred feet in a short distance. The scenery is very wild and beautiful. After following the brook for another half mile, the slope on the left should be attacked. Probably no water will be found after leaving the brook. A scramble of perhaps half an hour through low woods and underbrush will bring one out upon the clear portion of the ridge; and if he has as good luck as the writer he will see the boulder quite near, but separated from him by a belt of scrub about 100 feet wide. This passed, the ridge will be found bare and smooth, and the boulder is easily reached. It is not so large as one might expect; and the writer estimates it roughly as about 15 feet in each dimension. Two of the party climbed upon it with considerable difficulty. All fear of detaching the rock from its place was quickly dispelled; for it is planted firmly upon the ridge, and presents none of the threatening aspect that it has when viewed from the road below. The ridge may be easily followed for some distance above the boulder; but higher up it will be found to be completely covered with the most impenetrable kind of scrub. This ridge culminates in a decided summit, officially designated as L. 10, though it is properly a subordinate summit of the Mt. Washington group. It is doubtful if it has ever been visited, for the gentle, rounded form of its slopes would scarcely present a sufficient inducement to penetrate the dense and extensive patch of scrub which covers it. It would be best reached by descending from Boott's Spur along the bare ridge at the head of the Gulf of Slides, and aiming directly for the summit; the distance and ascent being inconsiderable as compared with the difficulty of penetrating the growth of scrub. The ridges and ravines south of Boott's Spur have been but rarely visited, and afford a most favorable field of exploration for those who are willing to enter pathless tracts of unbroken forest.

[1] Omitted from a previous Report.

Reports of the Councillors for the Autumn of 1880.

Improvements.

By A. E. Scott.

The suggestions made in the spring report of this department relative to the care of paths and camps constructed by the Club were favored by the Council, and, in accordance with their instructions, the first work done was repairing the Mt. Adams Camp and putting the Mt. Adams and King's Ravine paths into good condition.

Extensive logging had been done during the winter over both these paths, and considerable labor was required to remove the débris and the numerous windfalls. The work was done in season for early travel, and the paths and camp were kept in good condition during the season.

An arrangement was made with Mr. Lowe, who had been accustomed to request toll of all who used these paths, by which no toll should be taken during the year 1880, nor hereafter, so long as the Club keeps them in good repair. In consequence of this arrangement a very large number of people have been over these paths during the year.

The Mt. Willey path was also cleared out and improved, an additional sign placed on the easterly side of the railroad opposite the entrance, and a smaller sign where the path comes out into the bed of the stream, near the beginning of the trail leading to Ethan's Pond. This was a somewhat doubtful point before, but it is believed a stranger may now follow the path to the summit without difficulty. Considerable clearing was also done on the summit, and at the request of the Department of Topography a large cairn built in a very substantial manner.

Through the energy of Mr. Edmands a doubtful and somewhat dangerous place in the Hammond path on Chocorua, where it crosses ledges inclined at an uncomfortable angle, has been made plain and safe. Holes were drilled in the rock, into which iron bolts were firmly driven, and a log placed across the incline resting against these bolts.

The Swift River is so full of rapids that transient visitors in this valley often fail to find the true Swift River Falls. To make this point sure, a sign has been placed on the roadside opposite the Falls at the entrance of a short path leading down to the river's bed.

Dr. W. B. Parker, assisted by Lieut. H. C. Tallman and Charles P. Worcester, has kindly completed the work undertaken by him of marking and measuring the Carrigain and Livermore-Waterville paths. About a dozen guide-boards have been put up by him on each path at doubtful points, and the distance marked at the end of each kilometer. Through the kindness of Miss M. F. Littlehale this work has been done without expense to the Club.

The distance from the store at Livermore to the base of Mt. Carrigain was found to be a little more than five kilometers, to "Burnt Hat Ridge" about seven kilometers, and to the summit a little less than eight kilometers.

The exact distances are recorded on the distance-signs, and should be secured for a permanent record. The large sign left at Livermore last year was carried through to Beckytown, and nailed to the tree selected at the edge of the forest.

The signs prepared for the path were all used before reaching Waterville, so that a rough board only was placed on the corner of the house at Greeley's. It is suggested that some member of the Club stopping there next season will replace it by one creditable to the Club.

The distance from Livermore to the Swift River is a little more than eight kilometers, or almost exactly five miles, to Beckytown a little more than ten miles, and to Greeley's twelve miles.

We regret that the approach of winter prevented the completion of other work. A contract was made with Mr. Lowe for the construction of the path, suggested in the spring report, to the Ravine of the Cascades. This work is well in hand, and will be completed early next season. A contract was also made with Mr. James M. Shackford, of Albany, for the construction of a path from the Swift River Intervale to Church's Falls on Sabba Day Brook; also for the spotting of a trail from the same point to the summit of Passaconaway,

the clearing of the summit, and the building of a cairn for the use of the Department of Topography. This work has probably been completed, but no definite report has yet been received.

Early in July this department, assisted by Mr. Charles A. Wellington and two workmen, prospected for a path from Church's Falls to the summit of the south peak of Tripyramid. A very interesting and easy route was found on the right bank of the stream, and spotted nearly to the base of the mountain. The ascent of the peak itself is steep, and it matters little where it is attempted.

The distance from the Swift River to the summit by this route is greater than was supposed, and the estimated expense of building the path and clearing the summit was so large, and the promises of aid so meagre, that the department did not deem it advisable to undertake the work this year. It is believed that a shorter route may be found by passing to the north of the great mountain mass that stretches eastwardly from the range, and bearing toward the north or middle peak.

The Council appropriated a small sum toward constructing the path proposed between West Thornton and Warren, to connect the Pemigewasset Valley more closely with the region around Mt. Moosilauke. Early in the season an exploration was made, and estimates obtained of the probable distance and cost; but the work was delayed for want of sufficient funds. Later, chiefly through the efforts of Prof. Charles E. Fay, a sufficient sum was subscribed by visitors at Campton to construct the path half the distance. The Councillor in this department visited Warren three times, and was encouraged to believe that the people of that town would construct the remaining half. A contract was made with Mr. William M. Sargent, of Woodstock, to do the work; but, owing to the strange freaks of a letter containing the contract and the details of the plan, the work was delayed a month, and we were not apprised of the completion of the half contracted for until the 1st of November. We had agreed to go over the path and examine the work as soon as completed; and, true to our engagements, we were on the ground at the appointed time, and performed our part of the agreement in the

most furious storm we have had this season. Two days and a night in a mountain pass, in a cold northeast November storm of snow and rain, with the streams so swollen as to be impassable, and a thousand cataracts roaring down the mountain sides in watercourses dry only a few hours before, was the delightful experience afforded by this business trip.

Many were the solemn "bewares" when it was known that we were about to enter the forest in the face of such a storm; but we had come from Boston to Thornton to accomplish the work, and our woodsman and his assistant would not falter in the presence of any "city chap," and so with packs on our backs and chain in hand we started.

Chaining can hardly be a pastime under favorable circumstances, and constant stooping with freezing water coursing down one's back does not add greatly to its pleasure.

The path was examined, improved a little here and there, and faithfully measured. As night came on we found ourselves safely sheltered in the camp, which had been built as a part of this enterprise.

Woollen clothes may be wrung, and heat will in time dry them. The long night in the blackness of the forest, from about five o'clock in the afternoon until seven in the morning, furnished ample opportunity for this purpose.

The camp is built of logs, with a roof of split shingles, open in front, and large enough to shelter eight or ten persons. It is situated in a beautiful spot on the northerly side of the stream. We had crossed the stream without difficulty when we reached the camp, but a continuous rain of twenty-four hours, with the snow melting from the mountains, works a wonderful transformation in mountain streams. We heard the roaring and crashing through the night, and still were hardly prepared for the sudden disappearance of our camp-fire towards morning. We sat up and anxiously awaited the dawn. As daylight appeared we found that our small stream had become a wide and furious river, carrying everything before it, and that our camp was then an island, but threatened with speedy disappearance. We rescued our packs and started out, wading for Warren, not omitting, even under these discouragements, carefully to carry the chain the whole distance.

The path as now constructed starts at the tannery in West Thornton, a short distance west of the Profile House stage-road, crosses Hubbard Brook at this point, and follows the course of the stream on the southerly side until opposite the camp. Here it crosses, and continues to Warren from this point, with the main stream on the left.

At about one mile from the tannery a branch path has been cut about one-fourth of a mile to the great gorge, which is the chief attraction in this locality. The path is well built, and is suitable for horses under the saddle. It was a part of our contract that the summit of Mt. Kineo should be cleared, a cairn built, and a trail spotted to the summit from a point about a mile from the camp, and this work has probably since been done.

We have also arranged for starting the path from the stage-road in Thornton to avoid the circuit by the tannery. This will require about one-half mile additional cutting. A neat gate of our own has probably already been placed at the entrance, with a large guide-board on its post, lettered, "To Mt. Moosilauke and Warren, A. M. C. Path."

The distance from the crossing of the stream near the tannery to the camp is 6,612 meters, or four miles and thirty-five rods, and from the camp to the highway in Warren, about fifty meters less, so that the camp very nearly divides the distance.

Much to our disappointment the Warren people had done nothing on their half of the work, but we again approached them, and before leaving town had the promise of twenty men, and a day appointed the following week for a general attack along the whole line of the path.

Little is required on the Warren side save the clearing and straightening of an old logging-road which starts from the highway along the left bank of Baker's River, at a point about one mile across from the Mountain House, follows up the divide between Cushman and Kineo, and extends nearly to the camp.

We are hopeful that this work will be fully completed before the summer travel of 1881 begins.

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Exploration, WILLIAM H. PICKERING, Mass. Inst. of Technology, Boston, Mass.
Improvements, A. E. SCOTT, 95 Milk St., Boston, Mass.

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Batcheller, Miss F. C., Roxbury, Mass.
Benjamin, C. A., Salem, Mass.
Bill, Chas., Springfield, Mass.
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Brown, Benj. F., Lexington, Mass.
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Chapin, F. H., Hartford, Conn.
Cumner, N. W., Boston, Mass.
Cushing, Miss Maria, Salem, Mass.
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Davis, Joshua W., Boston, Mass.
Drake, Samuel A., Melrose, Mass.

Eastman, J. R., Washington, D. C.
Eaton, Miss Elizabeth K., Boston, Mass.
Eaton, Miss Mary A., Charlestown, Mass.
Edmands, Isaac P. T., Boston, Mass.
Eppendorff, John G., Brooklyn, N. Y.

Fenollosa, E. F., Tokio, Japan.
Fette, W. Elliot, Boston, Mass.

Glover, Luther W., Medford, Mass.
Gregory, Mrs. Mary, Cambridgeport, Mass.
Groce, Byron, Roxbury, Mass.
Gunnison, Almon, Brooklyn, N. Y.

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Hawes, Miss Charlotte W., Boston, Mass.
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Hill, James W., Salmon Falls, N. H.
Hollingsworth, George, Mattapan, Mass.
Hollingsworth, Mrs. George, Mattapan, Mass.
Hollingsworth, Miss Rose, Mattapan, Mass.
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Howell, Selah, Watertown, Mass.

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Ritchie, John, Jr., Boston, Mass.
Rogers, John K., Boston, Mass.

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Sawtelle, Miss Ellen C., Roxbury, Mass.
Sawyer, Mrs. Lydia A., Boston, Mass.
Shaw, Benjamin F., Lowell, Mass.
Start, William A., North Cambridge, Mass.
Sweetser, Edwin C., Philadelphia, Pa.

Talbot, Mrs. I. T., Boston, Mass.
Talbot, Miss Marion, Boston, Mass.
Tillson, Mrs. Henry F., Boston, Mass.
Tucker, Gilman H., New York City.
Tufts, Miss Abbie B., Charlestown, Mass.

Vose, Miss Mary L, Providence, R. I.

Warren, Henry P., Plymouth, N. H.
Wellington, Cornelius, Boston, Mass.

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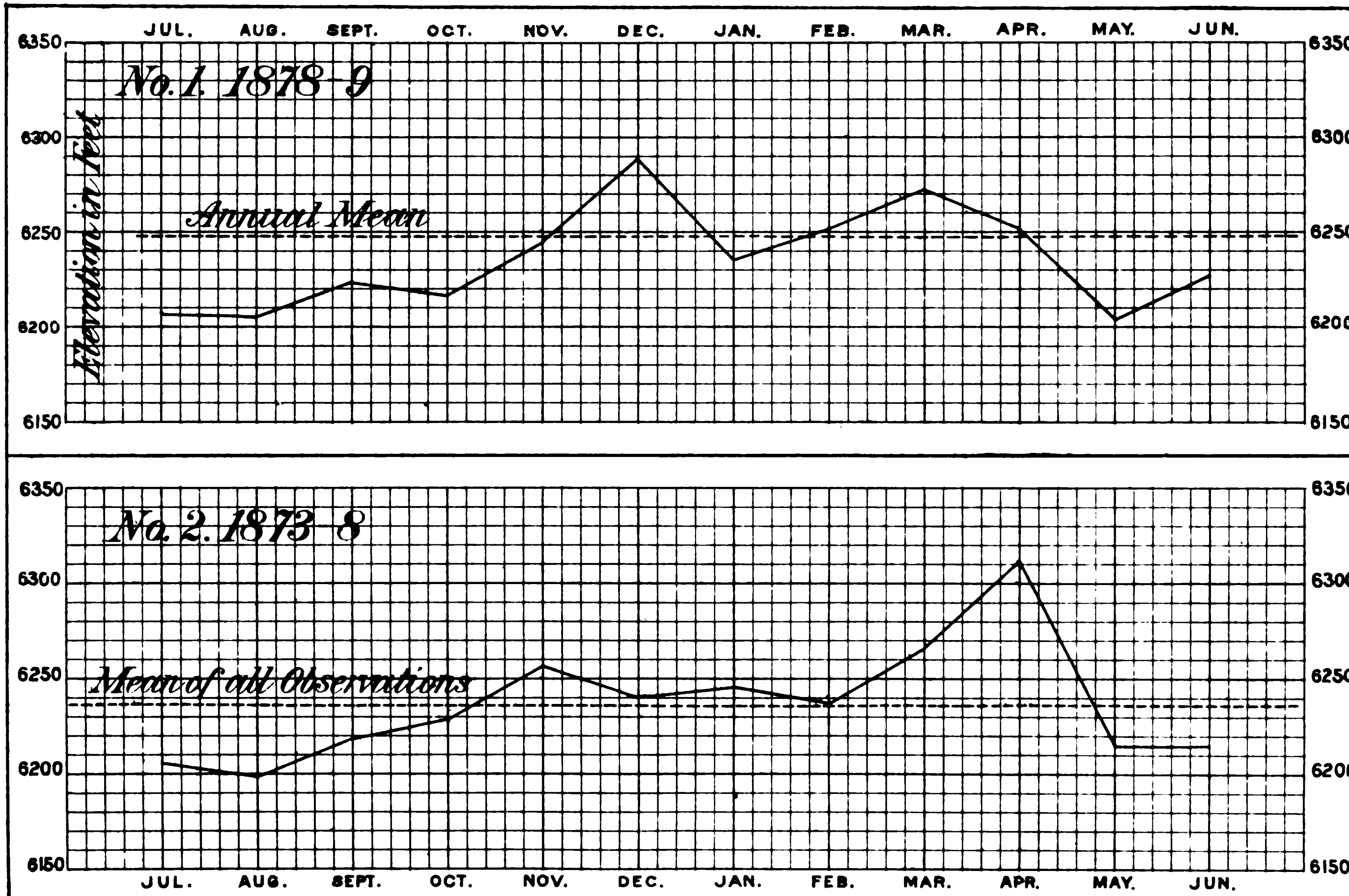
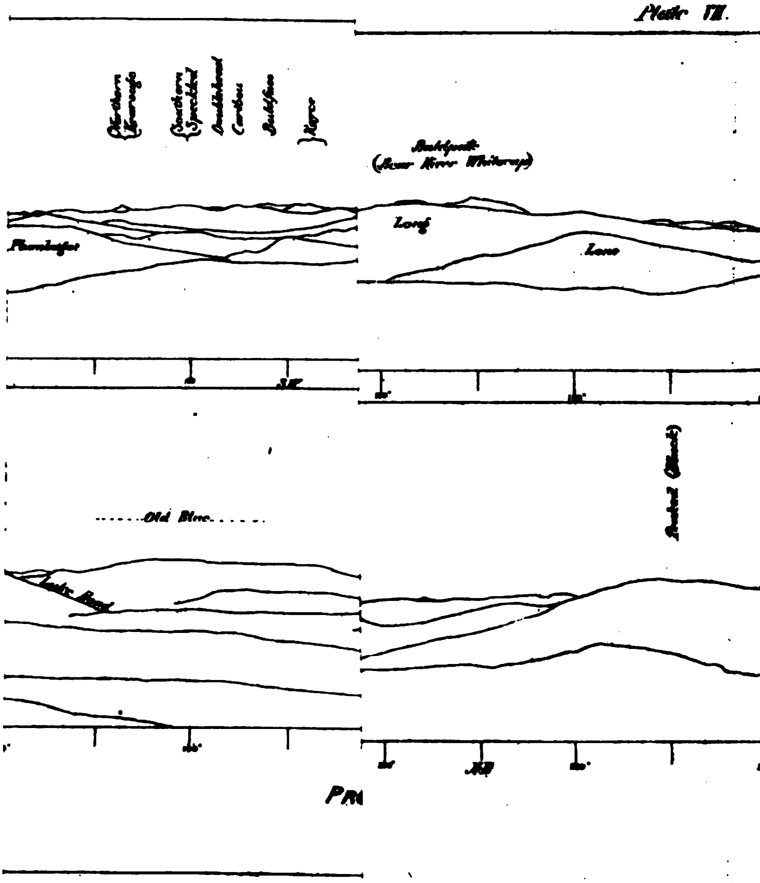
Nordenskiöld, Adolf Eric, Stockholm, Sweden.
Schwatka, Frederick, Washington, D. C.
Whittier, John G., Amesbury, Mass.



No. 1. 1878-9
Elevation in Feet
Annual Mean
No. 2. 1873-8
Mean of all Observations
6350
6300
6250
6200
6150
JUL.
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.

Plate VII.



APPALACHIA.

VOL. II. BOSTON, DECEMBER, 1881. No. 4.

Lake Dunmore and Vermont Midlands.

BY MARIA ELLERY MCKAYE.

Read February 9, 1881.

THE northern States of the New England group are remarkably individual. Maine, with her grand coast-line, and her pathless forests mirrored in innumerable lakes; New Hampshire, our American Switzerland, with all the granite grandeur of her ancient hills; and the sister State across the Connecticut, Vermont, "softly sublime, profusely fair," — interesting also from the romantic records of her early days. Ethan Allen is her Robin Hood. Possessing in an eminent degree the attributes of a popular hero, vigorous, fearless, and eloquent, he showed himself also to be a born leader, in following whom men "trod the path to death as 't were a festival."

Haunted by the memories of Ethan Allen and his brave comrades, Lake Dunmore lies in the heart of Vermont, midway between Middlebury and Brandon, about eighteen miles east of Lake Champlain. It is more than 1,400 acres in extent, and about five miles long and one broad, its maximum depth being from sixty to one hundred feet. A pretty island, about the middle of the lake, adds to its picturesqueness. Its inlet is Llana, its outlet Salisbury River. Thompson thus describes it in the opening chapter of his "Green Mountain Boys:" — "Of an oblong form, this lake lies extended between the main ridge and a collateral eminence on

the west, of a height but little more than sufficient to serve as a secure embankment to this noble reservoir of the hills. From the eastern shore the land rises abruptly into a lofty mountain. To the north and south open long and beautiful vistas, extending over the bright extremities of the lake and ending among the far-off peaks of the Green Mountains; while from the western shore the land, after a gentle rise, falls off rapidly towards Otter Creek, leaving the broad valley of that stream open to the vision, which now wanders unobstructed to the western borders of Lake Champlain. Beyond, the long chain of the Adirondacks bounds the view of this magnificent scene."

A wide level space on the north side of the lake, famed for its fertility and formerly called the "Indian Garden," is now occupied by the lawn, fields, orchards, and buildings belonging to the hotel burned down several years ago, and since then partially rebuilt. Standing on the lawn, facing the lake, you have behind you Mt. Bryant and Bear Mountain, each five or six hundred feet high. Prospect Rock, on top of Mt. Bryant, commands a fine view. To your right, casting a deep shadow in the afternoon, is Sunset Hill, 375 feet high. A pleasant path through the woods leads to the rocky summit, where you are richly repaid for the short and easy climb by the panorama spread out before you. To the west, at your feet, lies the valley of Otter Creek. Lake Champlain gleams in the middle distance, and beyond rise the lofty Adirondacks. Northward are the heights about Middlebury, recalling, by their grouping, the beautiful view from the cemetery at Brattleboro; while to the east and south, hills rise o'er hills, and Green Mountains over Green Mountains, from Bread Loaf to Rutland. When all the sunset glow has faded into sombre gray, and the distant mountains grow dusky, it is time to hurry down, especially if the moon rises early. The shimmering lake and the woods steeped in radiance are beautiful seen from shore; but the wise ones take to the water and, if sufficiently energetic, row to some distance. Once below the island, out of sight of lights on shore, and out of hearing of song and shout of boys and "campers," you can rest on your oars, floating lazily among

"the fire-flies tangled in a silver braid." The western shore is indented with gracefully curving bays, with here and there a bold promontory or steep cliff; but all along, the forest-covered ledge of limestone rises like a green battlement, making deep shadow at night and affording a delightful shade to rowers in warm summer afternoons. Towards the southern end, Mud Pond, a small sheet of water, lies behind this ledge, and is often visited by people in search of the calcareous tufa found there in large quantities, called in the neighborhood "petrified moss." Near by, from the lake shore, rises Fusyama or Sugar Loaf mountain, — famous, among the initiated, for its cedar labyrinth. To the northeast towers Moosalamoo, 2,317 feet above sea-level. The whole eastern ridge close to the lake is lofty, and goes by the name of the Neshobee Range, Neshobee being the Indian name for what is now Brandon.

The ascent of Moosalamoo is easy, but, owing to the obscurity of the path in some places, those who attempt it without a competent guide are apt to miss the best points of view. The prospect is very fine, similar, of course, to that from Sunset Hill, but far more extensive. To the north, Burlington Bay is in plain sight; and to the south and west of Lake Champlain crowd mountains innumerable. The eastern view is entirely shut out by trees. The dark, precipitous ledges of the mountain-side, all framed in verdure, are mirrored perfectly in the still depths of the lake beneath; and the effect is magical and startling when you suddenly come out of the woods and stand on a great projecting rock whence it seems as if you could drop a line plumb into the waters far below. The welcome refreshment as one lies in some sunny, sheltered nook, stretched on thick cushions of soft gray moss; the exhilarating air; the breath of the pines; the bright, gay berries of the mountain-ash, that "wave gladly into sight" from every cleft and cranny of the airy citadel that you have taken by storm, delight every sense; and you willingly rest your eyes from the grandeur far and near of this uplifted land, in the humbler loveliness of your immediate surroundings. Then the lingering leave-taking, the rapid descent, the look at Scala

and Llana falls in passing, the sunset row across the lake,— all contribute to the pleasure of a day on Moosalamoo.

Llana Falls, so named after the Mexican War in honor of General Wool, deserve more than a passing mention, celebrated as they are in themselves and for their rare setting of woods and rocks. Hitchcock, in his "Geology of the State of Vermont," tells how you step out on the edge of a cliff of hyaline quartz and look into a gorge a hundred feet deep. Through this magnificent gateway the Cascade Brook pours down. The volume of water, the peculiarly graceful sweep of the Long Fall, the stern and gloomy grandeur of the overhanging rocks, the varied foliage of the listening, gazing woods, the bending birches, and "the twilight parks of beech and pine," help to make Llana Cascades peerless among New England waterfalls.

Two miles farther from Lake Dunmore, embosomed in the hills, lies Silver Lake, accessible by a good carriage road from Brandon, as well as by the steep but pleasant way by Llana Falls. It is a lovely piece of water about a mile long, of an oblong shape, all framed in woodland, reminding you of a Highland *tarn*. The shore rises abruptly from the water, except towards the north, where a pleasant little inn stands on the edge of a broad meadow overlooking the lake. There is no distant view, for you are completely shut in by the hills, and the seclusion is perfect. The croak of a frog, the hum of insects or the plashing of your own oars is all that breaks the silent, waking spell; unless indeed you happen to go there in time of camp-meetings, that take place almost every year and attract large crowds.

The peculiarity of Silver Lake is its double bottom, which extends completely across one end, formed, it is supposed, of fallen timber driven to this side of the lake by the prevailing winds, wedged together and then thickly covered by the shining white sand blown from the shore. For more than a quarter of a mile, certainly, you row in shallow water, crystal clear, over a silvery bottom, till all at once the color changes to the darkest green, and the depth seems unfathomable; and so local tradition declares it to be. Scala Falls, too, are well worth visiting,—where a lovely brook flows translu-

cently over an emerald staircase, formed of regular layers of rock densely carpeted with the greenest of moss, all screened and embowered by the tangled wilderness.

On the western shore of Lake Dunmore, a few rods from the water's edge, in the deep shadow of Moosalamoo, is Ethan Allen's Cave; where, it is said, the famous leader gathered and hid his men before the surprise and capture of Ticonderoga.

Brandon is ten miles away, but its Ice Well is usually considered one of the attractions of Lake Dunmore. This phenomenon, about which so much has been written, is now supposed to be a deposit of ice, possibly the remains of a glacier, so enclosed in protecting strata of clay and gravel that it has been kept from melting to this day.

In the southeast corner of Brandon is Sugar Hollow, a favorite resort of trout fishermen, and once interesting from the black lead found there in large quantities. So Dr. Drury writes to Professor Hitchcock. In this region there is also a fine sea-beach, 600 to 800 feet above sea-level, reaching from Pittsford to Forest Dale; but in Ripton, nine miles north of Lake Dunmore, is the highest beach ever found in Vermont, 2,196 feet above the ocean.

The excursion to Bread Loaf Inn, at Ripton, is a favorite one; and, on the way, the narrows of the Gorge of the Ripton Brook can be seen by adventurous or carefully aided climbers. The wonder of the place defies description, and has never yet been attempted by painters or photographers. The Gorge of Trient and the Ausable Chasm give some idea of its character; but its virginal wildness makes it more beautiful than the first, and the curving lines of the water-worn rocks are far more graceful than the rectangular masses of the great Adirondack gorge.

One lovely summer day the little community, encamped in cottages at the north end of Lake Dunmore, was stirred by the tidings that two of their number were invited to take tea at the Painter Camp across the water, and at sunset the envied twain rowed leisurely over the iridescent lake to the little landing among the cedars in what is called Sanderson's Cove. The whole evening was one to be remembered, —

the twilight walk in the solemn shadows, the music and the moonlight; but best of all, it was then and there that we were invited to go to the Narrows of the Ripton Gorge, where never woman's foot had trod before. While discussing the "Italian salad" and fragrant coffee, we listened with great interest to the description of this remarkable place given by one of the guests, Mr. E., and gladly accepted an invitation to explore the Gorge at no distant day under his friendly guidance. Almost all of us had peered into this dark ravine on the way to Bread Loaf Inn, and had heard the roar and rush of the brook far below; but now we were to make our way along the bed of the stream, in true trout-fisherman fashion. A day was afterwards appointed; it proved favorable, and our guide appeared punctually with his great wagon and strong horses. The morning was pleasantly spent in a drive to a practicable descent in the picturesque part of the Gorge; and we had the promised scramble with its manifold delights, exploring the bed of the brook some distance below the Narrows. After lunch we resumed our places in the wagon, and found a pilot, leagued with our captain, in the person of an experienced trout fisherman of the neighborhood, who knew all about the place and could take us directly to the Narrows. He had often fished there; and, the year before, he had been one of the party to search for a lovely little girl, five years old, who, straying off by herself late in the afternoon, had fallen, it was supposed, from the precipice at the foot of which they discovered her remains. He gave us all the details of this sad event, and told how they traced the child's tiny footprints in different places from the bottom almost to the top of the ravine, showing that several times she was nearly in safety before the last fatal fall. Just above the spot where the little girl met her death, we began the descent. Here came "the tug of war." The gentlemen led the way down through the tangled bushes and over the trunks of fallen trees, mossy and mouldering. The footing in the deep leaf-mould on the precipitous declivity was very insecure, and after two or three hair-breadth escapes from what seemed imminent peril, hearing dislodged stones roll, rebound, and strike in the

undiscovered depths far below, the feminine leader lost heart and hurriedly retraced her steps, followed by all the other ladies, deaf to the shouted entreaties of their masculine companions.

Having regained the roadside and recovered their breath, they were all seated on a large log complacently congratulating themselves and each other on the superior good sense and discretion they had shown, when an indignant individual made his appearance at the top of the bank and bitterly reproached them for faint-heartedness, and, worse still, for want of consideration of their generous and kindly host, who had taken so much pains to bring them to this very place now close at hand. At last repentant, humbly accepting the aid hitherto rejected, they yielded; and after a great deal of plunging and slipping, with several more or less extensive landslides, they managed to reach the bottom of the Gorge; and once there, could not sufficiently rejoice that they had been induced to persevere. Standing where they could look up and down the brook, words and exclamations failed to express their delight. Falls above, — at their feet rapids, wonderful from the volume of amber water and the Titanic masses of rock that encumbered the bed of the stream, the awful beauty of the lofty walls of the dark chasm, softened by the curving lines of the arches and niches hollowed out everywhere in the water-worn rocks. Great bastions, garlanded and fringed with birches and cedars, were tapestried with mosses and lichens unprofaned by sacrilegious plunderers; while fairy ferns swayed in the undulating air above the turmoil of the roaring water. Down the stream, but close at hand, yawned an impassable chasm, perhaps eighty feet long, where the Gorge had contracted; and through this narrow passage the water rushed madly, heaping itself as it were between the perpendicular walls more than a hundred feet high. Those who had jumped across the brook declared that the view was still finer on the other side, and in a few minutes a tree was felled by our indefatigable host, and a bridge improvised for the womankind. Hardly had they crossed, however, when a loud shout of, "Come, quick! the water is turned on above!" brought them hurrying back again, and

not an instant too soon, for the great trunk, with the heavy stones that kept it in place, was swept away irresistibly by an impassable, foamy torrent from the mills higher up the stream. It was a narrow escape from an awkward adventure; but everything that day seemed to give a zest to the enjoyment. Instead of going back to the Lake we were carried off, not entirely against our will, to take tea with our kind entertainer at his pleasant farm, where the whole party partook of the genuine hospitality that denizens of towns sometimes find hard to practise, but which still exists in this part of New England.

Snake Mountain, or Grand View, is often visited by the "Lake-dwellers," who sometimes stay all night to see the sunset and sunrise. About seven miles east of Lake Champlain, nine miles from the town of Middlebury, this mountain rises abruptly from the level lands of Dead and Otter creeks to the height of 1,310 feet above sea-level, and 1,220 feet above Lake Champlain. You can drive on a good carriage-road all the way through the woods to the summit, where stands a comfortable inn kept by the proprietor whose grandfather owned the scow that ferried over Ethan Allen and his men to "Old Ti;" and from the ledge before the grandson's door you can almost look down into the historic ruin. The view from an observatory recently erected, is surpassingly fine, embracing all the highest peaks of the Green Mountains, as well as the grand ranges of the Adirondacks to the west, Lake Champlain lying almost at your feet.

The flora of Lake Dunmore is interesting. The walking-fern was found, till lately, in large quantities on the limestone ledges of the western shore, but it has been so ruthlessly torn up that it is now quite difficult to obtain. Cardinal-flowers bloom there in rich profusion, and the pond-lilies are very beautiful and abundant, growing in clear, deep water under the shadow of Moosalamoo. Beechdrops and squawroot are often found in the woods; and the bright scarlet berries of the American yew, or ground-hemlock, are to be found among the rocks above Llana Falls, and also along the road to Ripton. The *Cypripedium*

spectabile, the most beautiful of all the moccason-flowers, grows in cedar-swamps in the neighborhood, "wasting its charm for the most part on the earth and sky."

There is no great variety of game,—squirrels, of course, of all kinds, and a few hedgehogs; a bear is occasionally killed, and foxes have been seen on Sunset Hill. The fishing is good; brook trout weighing three quarters of a pound are often caught by experienced fishermen. Perch and large pickerel abound in the lake, as well as the trout, — the "silver-fish" that gives its name to the mountain, and formerly did so to the lake as well, Moosalamoo, meaning "silver-fish" in the Indian language.

The present name of the lake dates from colonial times. In 1771 Lord Dunmore, a royal governor of New York, was making an excursion with a small party of gentlemen from Albany to see this part of Vermont while it was still claimed by New York. At Sutherland Falls they engaged the services of two Indian guides, who brought them down Otter Creek to Leicester, and then through Otter Creek and Leicester River till they came to the present site of Salisbury Village, walking from there two miles over the hills to the lake, which they greatly admired. On the northwestern shore they rested and enjoyed the prospect; and after lunch it was proposed that the lake should henceforward bear Lord Dunmore's name, and he was asked to perform the appropriate ceremonies. Wading out a few steps with a bottle of wine in his hand, he poured its contents into the water, and all the company loudly proclaimed in chorus that ever after this sheet of water should be called Lake Dunmore, in honor of the Earl of Dunmore. Then the Governor told the two Indian guides to bend down a small tree standing near, and to split it at the junction of one of its main branches with the trunk. He inserted the bottle in the cleft himself, and bound it so fast that it could not be thrown out when the tree sprang back to its original position. Forty years afterwards a Mr. Jones of Hartford, Conn., established on this shore of the lake a glass-factory, broken up subsequently by the war of 1812, and Henry Schoolcraft, author of "The History and Condition of

the Indian Tribes," was for a time his manager. One day a man in his employ, while chopping, struck his axe into a heavy bottle imbedded in the crotch of a tree. This mysterious circumstance having been mentioned some time after in the presence of Mr. Henry Wiswool of Whiting, Vt., he was able to explain it, since he had been present on this occasion, and had seen Lord Dunmore put the bottle in the cleft. In this way the fairest sheet of water in the Green Mountain State came to bear the name of a royal governor of New York.

It would be difficult to give any adequate idea of the changeful beauty of this lake by any description. A celebrated sculptor once said of a beautiful woman, when he was told that she was about to have her portrait painted: "One picture of Mrs. D.? She should have her portrait taken every morning and every evening!" This is eminently true of Lake Dunmore.

Routes to Ktaadn.

By Charles E. Hamlin.

Communicated Oct. 20, 1881.

Mt. Ktaadn is so inaccessible that practically it is remote even to New Englanders. It is probably true that a greater number of eastern men now annually visit Pike's Peak than penetrate to the Maine mountain, and a hundred Bostonians have been among the Alps for one who has climbed Ktaadn. Of the few who have published narràtives of their excursions to this unique mountain, some have presented more or less definite accounts of the routes by which they reached it. Thus the delightful article of Thoreau, entitled "Ktaadn," is mainly a circumstantial description of his journey thither, rather than of the mountain itself, of which, since it was capped with clouds during his ascent, he neither reached the summit nor saw the most noteworthy features. But as the

reading of all that has been written relating to Ktaadn would yield distinct information upon only two of the four possible routes to it, it seems desirable to present at one view, and in narrow compass, the leading characteristics of all, — their relative lengths, advantages and disadvantages. It is the purpose of the present paper to furnish such a summary; and while the writer would hope that it may not prove useless to persons who take to mountaineering for pastime and as part of their summer recreation from business, his special desire is that it may serve, in some small degree at least, to turn eastward the attention of the Appalachian Mountain Club, so that he may not much longer count as being, of its some hundreds of members, one of only four who have visited Ktaadn.

Mt. Ktaadn is situated between what are usually termed the East and West branches of the Penobscot River. As a single step toward accomplishing a very desirable change of nomenclature which has been suggested, but scarcely to any extent adopted, let it here be said that the so-called West Branch, being the main river, and having many branches of its own, should be called the Penobscot; while what has been known as the East Branch is so important a tributary as to deserve the separate name, long since proposed, of Mattagamon, derived from one of the lakes which lie at its source. No further proof of the necessity of such a change will be needed than to note a single consequence of persistence in using the present names. Thus, if one should attempt to describe by them the course he would take in going from Moosehead Lake up the Penobscot to the head waters of the River St. John, he would be compelled to say that he travelled up the Northeast Branch of the North Branch of the West Branch of the Penobscot.

Ktaadn is crossed near its centre by the Monument Line, so called because it starts from the monument erected at the point where the head waters of the St. Croix River cease to be the eastern boundary of Maine, which northward from the monument is a straight line. It runs westerly, about four miles south of the parallel of 46°, across the State, which has

here a width of 125 miles.[1] The portion of the line, seventy miles in length, which lies between Ktaadn and the western boundary, traverses an unbroken wilderness; while the part which runs from the mountain to the eastern border, fifty-five miles, forms the south line of Patten and the north line of Sherman. These townships corner upon each other, and are the only incorporated towns touched by the Monument Line. The town nearest to the mountain, and the only one visible from it to the naked eye, is Patten, 22 miles distant in a straight line. From Ktaadn to the northern extremity of the State is 110 miles; the entire region, westward from the Aroostook settlements, being uninhabited. The nearest town on the south is Brownville, forty-two miles away, — measuring on the meridian. The intervening district is entirely unsettled.

It will be seen from the foregoing statements that Ktaadn lies in an immense wilderness. The whole country that is within view from the summit, except the clearings around Patten, and others to be distinguished along the Aroostook Road farther south, is a continuous forest, interspersed with lakes estimated, great and small, at upwards of one hundred in number. The general surface to the south has an elevation of not more than 50 feet above that of Pemadumcook Lake, which is set at 500 feet. In the north and east, beyond the heights adjacent to Ktaadn, the elevation can be but little greater; but on the west there is a gradual rise to Moosehead Lake, forty miles distant, and 1,071 feet above the sea. Viewed from the mountain, however, the whole expanse, in all directions, appears to be a great plain, broken, except by Ktaadn and its immediate lower neighbors, only by scattered and distant mountains; but as none within a circuit of fifty miles radius attain an altitude of more than 3,000 feet, Ktaadn, seen from the level of the country and standing apart, towers in most majestic style above the whole region round. Not a few summits, in themselves picturesque and

[1] The greatest width of the State, on the parallel of latitude from Quoddy Head to New Hampshire, is about 200 miles; while a diagonal line drawn from Kittery Point to One Hundred and Forty-four Mile Corner, the northeast angle as claimed by the United States before the treaty of 1842, was estimated to measure no less than 360 miles. Terminating now at the northernmost bend of the River St. John, the length of the line is about 300 miles.

striking, dwindle in the presence of their superior. None, near or remote, presents itself in any degree as a rival; but all, like dwarfs around a giant, serve, by the strong contrast they afford, to proclaim Ktaadn[1] undisputed monarch of the great wilderness he overlooks.

From Boston the tourist can reach Ktaadn with least delay by taking a night train, which leaving at seven o'clock is due in Bangor, 245 miles, at 5-30 next morning. After breakfast he can proceed at once upon his journey, whichever of the four routes to the mountain he may choose, by the European & North American Railway, or its branch, the Bangor & Piscataquis Road. If he takes either of the two more eastern routes, he continues on the former road fifty-eight miles to Mattawamkeag, situated at the junction of the river of that name with the Penobscot. If he decides upon one of the two

[1] The spelling *Ktaadn* has been here adopted in accordance with the opinion of the most eminent living authority upon Indian dialects, as presented in the following communication, addressed to the writer: —

HARTFORD, May 27, 1881.

DEAR SIR, — The name *Ktaadn*, or *Katahdin*, is formed from an adjectival, meaning "principal," "pre-eminent," and, so, "greatest," and a generic or class-name for "mountain." Neither of the two elements could be used as an independent word, but both were of frequent occurrence in composition, in the eastern Algonkin dialects. Rasles, in his Abnaki dictionary, spelled the adjectival *ketté*, the generic, *adene*; but the vowel sound between *k* and *t* of the first syllable was obscure and guttural, and hardly, if at all, definable by an English ear. Eliot wrote *keht-*, and occasionally *keiht-*; Roger Williams, *kut-*, and *kaut-*; Zeisberger, in Delaware, *kita-*, *kit-*, *kid-*, *get-*, etc. There was, in fact, so slight a separation between the *k* and *t*, that the two consonants seemed to combine, and the former was lost to Europeans generally. Thus Captain John Gyles — who had been a captive among the eastern Indians, and appears to have had a good knowledge of their language — wrote of "the White Hills called the Teddon at the head of Penobscot River;" and the modern *Titicut*, on Taunton River, is the *Cotuhtikut* of the early settlers, and *Ketchtukqut* of Eliot. I do not find that any writer, whose ear has been trained to Indian sounds, has represented this prefix by *kat*, except in the name *Katahdin* and one of its equivalents, *Catatonk*, in Tioga County, N. Y. In another equivalent, *Kittatinny*, "the greatest mountain," of the Blue Mountain chain, it has settled into *kit*. . . .

One of the party whose "Camps and Tramps" [referred to in a letter to which this is a reply] were chronicled in "Scribner's," has a good ear for Abnaki sounds, and was at some pains to acquire the native pronunciation of this mountain name. He was not at all satisfied with *Katahdin;* and I agreed with him, on the whole, that *Ktaadn* is, of the two, the better Penobscot. Yours truly,

J. HAMMOND TRUMBULL.

western routes, his train quits the first named road for the second at Oldtown, twelve miles from Bangor.

A passage to Bangor, attractive for the views it affords of Penobscot Bay and River, may be made by steamer leaving Boston daily at 5 P.M., and reaching Bangor the following noon. The traveller will stop there for the night, or take the afternoon train, according as his route and its stage connections may render desirable.

THE FIRST ROUTE, *via* MATTAWAMKEAG AND THE PENOBSCOT.

The oldest route to Ktaadn, and consequently the one most fully described, follows the course of the Penobscot all the way from Bangor to the point where the ascent begins. From Mattawamkeag a stage runs the first eleven miles to a little village at the mouth of the Mattagamon, formerly designated upon the maps as Nickatow (the *forks*), but some years since incorporated as the town of Medway, its significant Indian name being dropped for one threadbare and unmeaning. Here highways at present end and roughing begins.

At Medway, guides may be obtained, who, for the brief and rapid trips to the mountain usually made by visitors, prefer to use birch canoes, — the guide and one man, sometimes two, with their outfit, occupying a birch. When more time is to be taken, with greater weight of supplies and more than two persons to a boat, the light wooden *bateau*, pointed at both ends and much used upon the inland waters of Maine, is preferable as being stronger and more durable than the frail birch. Since from Medway to the Grand Falls the river is full of rapids, boating is there exceedingly difficult, except at unusually favorable stages of water. It is therefore advisable to take boats and baggage from Medway upon a strong team-wagon over the rough cart-way which follows the river thirteen miles to "Old Fowler's," the last house upon the route, situated up the Millinoket Stream, two miles from Shad Pond, the lowermost of the lake-like expansions of the Penobscot. A little below Fowler's the low water of summer allows the stream to be forded, and

the load is drawn two miles more, across the rock-obstructed Fowler's Carry, to the river above the falls. This portage has been in use since the earliest travel by white men began, and undoubtedly follows the course of an ancient Indian carry. As late as 1871 the writer found only a blind trail over the four miles next below Shad Pond, where navigation of the river was the only resource; but in 1878 a rude road had been cut and was, as now, in use for the transportation of boats and outfits for parties.

From Fowler's the journey is made by boat on the waters and for the distances to be named. After a short run through rapid water in the river, the way lies through Quakish Lake, two miles; thence one mile through furious rapids, that require all the strength and skill of practised boatmen to ascend them by poling, to North Twin Dam; thence a mile more of river, or — as a reach of running stream connecting two lakes is here termed — of "thoroughfare," leads into North Twin Lake, four miles long, from which another of a few rods only opens into Pemadumcook Lake, largest of the chain and ten miles in length. About three miles of boating in this lake reaches a part of it called Deep Cove, two miles long and terminating in a passage into Ambejijis Lake, which is two miles long. It may be approached also by running on Pemadumcook about four miles, nearly to Gull Rock, opposite the outlet of Lower Joe Merry Lake; and thence by a channel, sometimes troublesomely shallow, two miles to the entrance into Ambejijis. Here on a point stands a log camp, dignified with the name of the Ambejijis House or Boom House, from the boom that stretches across the passage. This and a similar one at the North Twin Dam, are the only roofs between the Head of Chesuncook and "Old Fowler's," a distance of more than sixty miles. They were built and are kept up for the accommodation of passing lumbermen and river-drivers, and are familiar points from which distances up and down the Penobscot are reckoned.

A more direct course from Fowler's to Ambejijis Lake is in rare instances taken up Millinoket Stream, six miles, to the lake of the same name; and through that, some seven miles, to a portage of four rods over a bush-grown sand-flat

which separates Millinoket from a lagoon extending eastward from Ambejijis. The stream is sluggish and unobstructed through its lower half, but extremely rapid and rocky for two miles or more below the lake. The experience of a party, of which the writer was a member, while descending the stream in 1871, and that of another party in 1878, do not lead him to advise navigating Millinoket Stream as a short cut to or from Ktaadn; and the lagoon between the two lakes, through which light boats could barely be thrust in '71, becomes in dry seasons, like that of '80, an expanse of mud passable neither by boat nor on foot.

At the head of Ambejijis Lake the river is again entered, and is followed for the nine miles of boating that still remain. In this short space occur five falls, requiring usually, at midsummer, as many portages. Here the river widens at short intervals, as it does all the way from Shad Pond to Chesuncook Lake, into still lakes connected by narrow and rocky thoroughfares, upon which are the falls and rapids. For the twenty-three miles between Ambejijis and Ripogenus lakes, the expansions are of width so moderate that river-men do not style them lakes, but *dead-waters*. There is a fixed order, not destitute of interest, in which the names succeed each other. For the nine miles, at least, now under consideration, a fall, the dead-water next below, and the tributary of the river next above the fall, all bear the same name, as will be seen from the following list of names and distances, which those who pass through this wild district will desire to know. Ambejijis Falls and the portage of ninety rods around them have, for their dead-water, Ambejijis Lake, a few rods below. Next above follows Passamagammet Dead-water, a mile and a half in length, Ambejijis Stream entering from the right. Then come Passamagammet Falls with a portage of twenty rods, or, in very low water, of several times that length. Next is Katepskonegan — often corrupted into Debskoneag — Dead-water, a beautiful but shallow lake, two miles long by half a mile wide, into which Passamagammet Stream debouches on the left. Directly from the head of the dead-water succeed Katepskonegan Falls, longest of the series, occupying about seventy rods of the channel and requiring a portage

variously estimated at from seventy-five to one hundred rods in length. Above this lies the comparatively narrow and river-like Pockwockamus Dead-water, from two and a half to three miles long, Katepskonegan Stream coming in on the left. Pockwockamus Falls, next in order, occupy twenty rods of the river's bed, and are passed by a portage of about twice that length. Thence follows Aboljacarmegus[1] Dead-water, three fourths of a mile long to the falls of the same name, twelve rods in length, where there is no cleared portage but only a driver's path, boats being, at good pitches of water, poled or warped over the falls. Lastly succeeds half a mile of quick water to the foot of Sourdnakunk Dead-water and the mouth of Aboljacarmegus Stream on the right.

The first men who are known to have ascended Ktaadn went this way. In August, 1804, "seven gentlemen from Bangor and Orono,"[2] with four boatmen, including two Indian guides, passed up the river from Orono, seven miles above Bangor, where roads then probably terminated. Their ascent of the mountain was described by one of the party, Charles Turner, Jr., of Boston, who was employed several seasons by proprietors in surveying Penobscot lands. The ordinary duties of his profession at that early day could not have called him into this then unexplored region. His interesting and valuable account, part of a private letter, was printed in the "Collections of the Massachusetts Historical Society," under the title of "Description of Natardin or Catardin Mountain."[3]

The next two excursions to Ktaadn of which accounts

[1] Written also *Abala-jako-megus* (Willis, Maine Historical Collections, vol. iv.), *Abala-jacko-megus* (Williamson, History of Maine, i. p. 93), *Abawljacarmegas* (Prof. J. W. Bailey, Am. Jour. Sci. [1], vol. xxxii. p. 28). In speaking, the name is habitually shortened into *Aybol*. The term is said to signify Smooth Ledge, and accurately characterizes the rock underlying the falls, from which the name is evidently derived. The stream itself is *Aboljacarmegusquoik*. Thoreau calls it Murch Brook ("Maine Woods," pp. 53, 58), a name probably borrowed from his guides. Another common name for it is Sandy Stream, from the nature of its mouth, — for other parts, an egregious misnomer. The *Aboljacknagesic* is a stream which enters the Penobscot a few rods above the mouth of the *Aboljacarmegus*. The signification of the term seems not to have been traced.

[2] Williamson, History of Maine, vol. i. p. 92.

[3] 2d Series, vol. viii. pp. 112–116, 2d ed., 1826.

exist in print, were made over this route. They were that of Professor J. W. Bailey of West Point, in company with Professors George W. Keely and Phinehas Barnes of Waterville College, August, 1836; and that made in September, 1837, by Dr. Charles T. Jackson, then State Geologist.[1] Jackson's party went by bateau all the way from Oldtown, going above Fowler's through Millinoket Stream and Lake. Bailey and his companions rode to Mattawamkeag, the terminus of highways along the river at that time, and thence followed "a blind path," which they often lost, along the shore to two log-cabins then standing six miles below Grand Falls, whence they proceeded by boat to the usual place for beginning the ascent. A paper relating to this trip, from the pen of Professor Bailey, was published in the American Journal of Science.[2]

In September, 1846, Thoreau pursued the same route, and he, too, found beyond Mattawamkeag only "an obscure trail up the northern bank of the Penobscot, . . . the river being the only highway." Following the trail eighteen miles to the clearing of George McCausland,[3] who with his brother had been, ten years before, guide for Bailey, Thoreau engaged his services. Four miles more of trail brought the party to Shad Pond, where "Young Fowler" was just building his log-house. Going to "Old Fowler's," two miles more, they made the Fowler Carry and followed the course already indicated. Thoreau's narrative of this excursion occupies the first eighty-four pages of his "Maine Woods."

From the mouth of Aboljacarmegusquoik the path up the mountain, now well established and known to guides, lies along the shore of the stream for half a mile, when it turns short to the left and follows a spotted line about four and a

[1] Second Report on Geology of Public Lands, pp. 6–20.

[2] 1st Series, vol. xxxii. pp. 20–34, October, 1836.

[3] Bailey's spelling of this name, *McAstlin*, and Thoreau's, that of *McCauslin*, came from a mispronunciation common in Maine, and most nearly represented by the form, *McAstlin*. Should any reader think these details superfluous, Thoreau's words are sufficient answer: — "I am particular to give the names of the settlers and the distances, since every log-hut in these woods is a public house, and such information is of no little consequence to those who may have occasion to travel this way." McCausland's place is still one of the points of reckoning; and he is yet living, and a most interesting character.

half miles to the foot of that part of the great Southwest Slide, of 1816,[1] which is not yet wholly grown up to forest. A trail or path, literally speaking, does not exist; for although most of the travel up Ktaadn goes this way, it is so small in amount and confined to so few weeks of the year that human feet have left visible marks at very few spots along the line, so that expert guides direct their steps by the spotted trees. From the junction of the trail the slide[2] is followed to its head, three fourths of a mile over a portion overgrown at intervals with bushes and small trees, and thence one mile and three quarters up the steeper, loose, present slide proper. From the head the ascent is for half a mile over a surface piled with huge bowlders, and having an average inclination of about 35°, but at the upper part of 47°, to the sharp brow of the Table Land, the first summit. Thence a walk of about a mile, half way up on the slightly inclined plateau, and the rest up a moderate slope, brings the tourist to the West Peak, distant about one third of a mile from East Peak,— the two differing in elevation not more than twenty feet. The distance, then, from the starting point of the trail upon the river to West Peak is, according to the estimates here given, nine miles.

The base of the mountain is very commonly spoken of as lying several miles from the river. In fact, from the Aboljacarmegusquoik the trail makes almost immediately two sharp ascents, and the summit of a hill about two miles on the way is 700 feet higher than the river, as determined by means of an aneroid whose readings, throughout a stay of four weeks, agreed closely with those of a Green's barometer. In the course of the next half mile a descent of fully 100 feet is made, followed, in the two miles thence to the junction of

[1] Williamson, History of Maine, vol. i. p. 90.

[2] As the Southwest Slide did not come into existence until 1816, Turner, in 1804, reached the Table Land by way of the southwest spur. The writer took the same course in 1869. The slopes of the spur are less abrupt than those of the slide, and would therefore be easier of ascent were it not for a belt of spruce scrub, which at its highest part becomes impenetrable, and can be passed only by walking upon the tops of the interlacing shrubs. If a path were cut for a short distance through this troublesome growth, travel would no doubt be largely deflected to it, though the Southwest Slide should be climbed by the tourist at least once, as being one of the grandest features of the mountain.

the trail with the old track of the Southwest Slide, by a steady rise of 850 feet, or 750 feet higher than the hill-top before mentioned, making an elevation of 1,450 feet above the Penobscot. It is here that the foot of the mountain seems generally considered to be, while the foregoing statements show that the ascent really begins from the shores of the river.

Even Turner, the first describer of Ktaadn, who ascended over a more gradual slope somewhat farther west than the present trail, and over ground then recently laid bare by fire, remarks: "Round this mountain on the west, south, and east sides is a table-land,[1] extending about four miles, rising gradually to the foot of the mountain. This table-land is much elevated, and overlooks all the country except the mountains; when viewed from the mountain, however, it appears like a plane." It is the fact expressed in this last clause which so generally misleads visitors with respect to the actual base of the mountain.

THE SECOND ROUTE, *via* BROWNVILLE AND THE JOE MERRY LAKES.

What will here be considered for convenience as the second route to Ktaadn, has its last thirteen miles in common with the first. Thirty-two miles of it are known to few except lumbermen and hunters, who almost exclusively travel it. Regarded as beginning at Bangor, the route follows the European & North American Railway twelve miles to Oldtown, and thence the Bangor & Piscataquis Road to Milo, thirty-nine miles. Staging five miles to Brownville, and taking private conveyance five miles more to the limit of highways in that direction, one may go by a wood-road three miles to the log-house of Elisha Norton, the last dwelling on the route, and thence by a loggers' road nineteen miles to the Middle Joe Merry Lake; or, to save land travel in part, he may boat seven miles upon the northern part of Schoodic Lake, and thence strike the road four miles beyond Norton's. For the fifteen miles through the woods from Schoodic, or the whole twenty-two by way of Norton's, boats and supplies

[1] Not what is now styled the Table Land

must be drawn by horses, upon a rough sled called a *jumper*, to the Middle Joe Merry. About twelve miles is all that a pair of good horses can accomplish in a day, drawing in this primitive style two boats and stores for a party of six; although the road is remarkably level, smooth for a forest road, and kept free from bushes and windfalls by annual lumbering operations. The writer having taken this route, in 1869 *via* Norton's, and in 1880 by way of the Schoodic, can vouch for the loggers' road as one of the best of its kind. From its end, the way lies through the Middle and Lower Joe Merry lakes, through the long and difficult thoroughfare which constitutes their outlet into Pemadumcook Lake, and directly across the latter to the Gull Rock channel leading to Ambejijis Lake, a distance by water of ten miles. The whole distance from Brownville village to the mouth of the Aboljacarmegusquoik is, by this reckoning, forty-seven miles.

Both the routes now described are highly attractive for the beautiful scenery which the ever varying forests, river, and lakes present, the rapid succession of new impressions and experiences; and, to sportsmen, in respect to the facilities for hunting and fishing offered at the proper season. Of this northern wilderness, no more graphic and truthful description can be desired than that which Thoreau has furnished in his "Maine Woods." Interesting views of mountains are to be enjoyed upon most of the lakes, notably from Millinoket, Ambejijis, and Pockwockamus. The southern and southeastern aspects of Ktaadn present it stretched at full length, and though these are not the most "pictorial" views, they convey the strongest impression of its size and mass. None surpass them in exhibiting several of the most remarkable features. One of these is the unusual height of bare and rugged rock-surface exposed above the tree-line, which strikes every observer, and is probably the result of two things combined, — the steepness of the mountain's sides, and its high latitude. Ktaadn is more than a degree and a half farther north than Mt. Washington, its highest peaks, according to the determination of Professor M. C. Fernald, lying upon the parallel of 45° 53′ 40″, — that of 46° running somewhere across its northern base.

The only thing that to any eye can detract from these southern views, is the appearance to which Thoreau refers when, speaking of one of them, he says: "The summit had a singularly flat, table-land appearance, like a short highway, where a demi-god might be let down to take a turn or two in an afternoon to settle his dinner." Photographs taken from various points show that the remark is applicable only to views had at short distances from the base, whence foreshortening brings the peaks down almost to the level of the nearer linear brow of the Table Land. Still, in a perfectly clear day, the view of the mountain from the nearest stations on the south, can hardly be surpassed for certain fine effects.

Some distant views from considerable elevations are admirable, as, for example, that from Joe Merry Mountain — a height seldom visited. From a lofty hill directly west of Brownville village, Ktaadn is seen to remarkable advantage, though it is above forty miles off in an air line. The intervening country appears to be a continuous forest-clad valley, without a single conspicuous elevation, save the great mountain that fills the northern horizon. It is visible from the very roots, and the slides — white stripes in a surface elsewhere dark and sombre — give a most forcible impression of the steepness and length of its slopes.

The views from Millinoket Lake, and one that can be enjoyed from the road in front of the hotel at Medway, may be mentioned as offering something of the attractions which, as will be shown, are presented by the more eastern aspects of the mountain.

THE THIRD ROUTE, *via* MOOSEHEAD LAKE AND PENOBSCOT RIVER.

For this route a morning train runs from Bangor to Oldtown, and thence sixty-three miles on the Bangor & Piscataquis Railway to Blanchard, twelve miles from Greenville at the foot of Moosehead Lake, which is reached by stage, — the whole distance being eighty-seven miles from Bangor. On his way from Boston, the tourist may take at Newport, half-way between the Kennebec and Penobscot rivers, a

branch train to Dexter, fourteen miles, and ride thence thirty-eight miles by stage to Greenville, reaching the lake by either course early in the afternoon. The stages run daily, and make close connections with trains and the lake steamers. In good weather the stage ride is enjoyable. The Piscataquis range of mountains, which runs north of the river of that name and nearly in its direction, exhibits several prominent summits, of which Boarstone, on the east, and Russell, on the west, are chief.

The distance from Greenville to the head of the lake is called forty miles, but is believed to be something less. The mountain and island scenery, in view from the southern half of the lake, is rich and varied. The principal mountains are bold, but graceful in outline. They are Squaw Mountain, at the southwest extremity, Misery Mountain, distant in the west, the two noble Spencer mountains and Kineo, on the east. These, with the Lily Bay mountains and other minor elevations, add varied interest to what would otherwise be a monotonous landscape of forest continuous around the whole lake. It is broken only on the edge by the little village of Greenville at the foot, a single house at the head of Kennebec River — the outlet — the Kineo House, midway of the east side, half a dozen farms scattered along the shores, at great distances from each other, and a hotel at the head. But of all the mountain views that of Ktaadn, forty miles distant, is grandest, if seen from the right points and by the best light. Such an one, enjoyed by the writer near the close of a clear day of September last, with the aid of a glass, from the steamer's deck, while running from the Kennebec Dam in the direction of Spencer Bay, impressed itself as one of the finest of very many which he has seen from numerous points. By forenoon light the view of Ktaadn from the lake is far less striking. The landscape visible from the north half of Moosehead is comparatively tame, and is relieved only by changed aspects of the mountains already mentioned. Ktaadn and Kineo are hidden from each other by the intervening Spencer mountains.

Guides are usually engaged at Greenville, or the Kineo House. They furnish canoes, tents, and cooking utensils,

their employers providing their own blankets and food for the whole party. Preliminaries settled, passage is made by steamer to the Northeast Carry, at the head of the lake. Here teams are at hand to convey boats and baggage across the carry, two and an eighth miles, to the Penobscot. Launching upon the river, the course lies twenty miles in a northeast direction to Chesuncook Lake; through that, sixteen miles southeast to its outlet; and again, more easterly down the Penobscot, about seventeen miles, to the mouth of Aboljacarmegusquoik, where terminates the third as well as the first route. The most northerly point of this course, the junction of the river with Chesuncook, lies about five miles north of the parallel of 46°, if the published maps may be trusted.

The twenty miles between Northeast Carry and Chesuncook Lake are in great part dead-water, nowhere, however, expanding to greater width than thirty rods. The sluggish water is at intervals interrupted by the usual shallow rapids. At a medium pitch of water, these *rips* and Pine Stream Falls require no carrying, a birch being ordinarily lightened of its passengers, and then run or, if the water is scant, led down by the guide wading alongside. The shores are low, as are also those of Chesuncook Lake, which has no islands, and is commonly estimated as eighteen miles in total length, and a mile and a half in average width. From Chesuncook nearly to the little Ripogenus Lake, three fourths of a mile, the river makes a constant succession of falls, wholly impracticable for boats. The portage around them is mainly smooth as a turnpike, and in beauty is worthy of fairy-land. Ripogenus is a miniature lake, between one and two miles long. The elevation of Moosehead Lake above the sea is estimated as 1,071 feet; and that of the Penobscot, at Northeast Carry, as forty-eight feet less, or 1,023 feet; while Ripogenus Lake has an elevation of 878 feet, a descent of 145 feet in about thirty-seven miles. From the foot of Ripogenus begins a narrow gorge, three miles long, and walled on each side by cliffs, in some places vertical to the height of fifty feet or more. Through the whole length of this ravine the river rushes in continuous falls and rapids, making a descent of 215 feet in

the three miles, down to the level of 663 feet. The portage past the gorge, upon its upper half, could be traversed by wheeled vehicles, but the other half is piled with granite bowlders, and exceedingly difficult, so that Ripogenus Carry has the bad reputation of being both the longest and hardest portage upon the Penobscot.

Below Ripogenus Carry the river is comparatively smooth for two and a half miles, and then widens into the beautiful Ambajemackomus Dead-water, about a mile long by a fourth of a mile at its broadest part. Next follows a portage half a mile long, at the foot of which the Penobscot plunges ten feet over a perpendicular granite ledge, constituting Ambajemackomus Fall, followed immediately by the dangerous rapids known as the "Horse Race." Below these a canoe can run safely three or four miles to the series of rapids styled Sourdnahunk Falls, which require a portage of forty rods. Just above them comes in the Sourdnahunk Stream on the left, while below follows Sourdnahunk Dead-water, into which, at the distance of two and a half or three miles open, by mouths only a few rods apart, the Aboljacknagesic and Aboljacarmegus streams, in the order of their names.

Seen by favoring light, Ktaadn shows well from the whole length of Chesuncook Lake, but to greater advantage from the walls of the nearer Ripogenus Gorge. Winthrop's panegyric[1] of Ktaadn, as viewed from the latter, is not extravagant. Here, and from Sourdnahunk Falls, the relation of the Table Land to the chief peaks, and to the northern mountain, is best exhibited.

THE FOURTH ROUTE, *via* SHERMAN AND THE WASSATAQUOIK STREAM.

This route requires special notice, as being the one over which the tide of visitors that must soon set towards Ktaadn is destined to flow. It may be travelled with least delay by taking, from Bangor, the morning train of the European & North American Railway, fifty-eight miles north by east to Mattawamkeag, and thence northward by a connecting stage

[1] Life in the Open Air, pp. 76 and 83.

twenty-four miles to Sherman. For the first seven miles, to Molunkus, the stage runs upon the Military Road, built by the United States in 1834, for the movement of troops and supplies to the frontier post of Houlton. At Molunkus, where passengers stop to dine, the Aroostook Road begins, which the route follows, through the wild township Number One of the Fifth Range, and the Irish town of Benedicta, to the "Third of the Fifth," — to use the abbreviated expression current in Northern Maine, — known as the town of Sherman since its incorporation during the late war. Arriving here at from 4 to 5 P. M., according to the condition of the roads, it is convenient to stop for the night at the Aroostook House, kept by Mr. Boyington. At this house the Aroostook Road is left; and the way, turning directly west, four miles farther on, in the Third of the Sixth (now the plantation of Stacyville), changes from a smooth highway to the worst of cart-tracks. The author of the article, "Going to Mount Katahdin," published in "Putnam's Monthly" for September, 1856, wrote that it "made Pinkham Notch [as it was then] look smooth, and the North Conway paths appear like English lawns." Six miles of such a road leads through the unsettled Third of the Seventh to the Mattagamon.

Here a clearing was made as early as 1835, and a timber house erected for the entertainment of lumbermen, still called "the Hunt House" from its original proprietor, long since departed. A logging-road begins on the opposite bank of the river and, following it up a mile, crosses the Wassataquoik Stream, a branch of the Mattagamon; and six miles farther northwest makes a second crossing of the same stream. From the last crossing, the loggers' road continues five miles to Ktaadn Lake, where it ended till after 1870.

In 1846 Rev. Marcus R. Keep (an historical name as respects Mount Ktaadn), a hardy pioneer preacher of Aroostook County, made his first visit to the mountain and entered the Great Basin, of which he says: "So far as I can learn, I was the first human visitor to this fabled residence of the Indians' Pamolah."[1] In June, 1848, he marked out, and partly bushed from the terminus of the logging-road at

[1] Springer, Forest Life and Forest Trees, p. 198.

Ktaadn Lake, the first path ever opened to the mountain, known as the Keep Path. For this service the Maine Legislature granted him, some years later, two hundred acres of wild land, which he "located" on the south shore of Ktaadn Lake. By his path Mr. Keep went one or more times annually, often at the head of parties, till 1861; when he led his last party,[1] that of Mr. C. H. Hitchcock, who was then engaged in the geological survey of the State. The Keep Path ran to the foot of the East Slide where, properly speaking, it ended, since the slide itself was used as a thoroughfare to the top of the eastern spur; and that in turn was climbed to its summit, the First Peak, so called because it was the first one surmounted by comers on this path.

By this course went, in August, 1849, the women who first made the ascent of Ktaadn, Mrs. Elizabeth Oakes Smith (known a few years later as Mrs. Oaksmith), wife of Seba Smith, the once famous Jack Downing, and her companion, a lady from Bangor. They, however, only reached First Peak, which is separated from the highest ones by the most remarkable part of the mountain. Mr. Keep himself claims, in a letter published at the time in the "Bangor Democrat," that five women of a party which he conducted thither, a few days later than Mrs. Smith's visit, were the first of their sex who ever ascended the highest summits. The article in "Putnam's Monthly," already referred to, admits the claims of the two parties mentioned, and records the adventures of the third ladies' party, led by Colonel T. W. Higginson, which, however, like the first, went no farther than First Peak, now styled Pamola. Years ago there was in print a report that Mrs. Lydia Maria Child was the first woman who made the ascent of Ktaadn; but since her death a relative, familiar with her early history, affirms that Mrs. Child's Maine journeys never extended to that mountain.

The Keep Path was travelled by the few who took the eastern route, as late as 1874. In 1872 lumbering was begun

[1] We had the good fortune this year to induce Mr. Keep, whom we had not before met, to go from his home in Ashland, sixty miles north of Sherman, and tent with us in the Basin, — his first visit since 1861. Acknowledgment for our drafts on his knowledge of the region are due to the veteran explorer.

beyond Ktaadn Lake, and from it a road was cut five and a half miles to and along a swift mountain torrent which for nearly its whole length tumbles over bowlders. Yet to it lumbermen have attached the misleading name of "Sandy Stream," because, like any other torrent, bearing its finest débris farthest, it has deposited beds of fine granitic sand about its opening into Millinoket Lake. The lumbering operations at Ktaadn Lake soon badly obstructed the Keep Path with tree-tops left by the choppers; and, as the five and a half miles of new road led directly towards the Great Basin, the old course was abandoned, and in the fall of 1874 some young guides spotted a line thither from Sandy Stream. The new trail has since taken all the travel.

The stagnation of business that followed the close of 1873, brought lumbering in this quarter to a disastrous end, and the road beyond Stacyville, then at its best estate, rapidly deteriorated. The condition in which the writer found it, in the successive years of '79, '80, and '81, will show what tourists going that way to Ktaadn must at present encounter. Traversing a continuous series of rocky hills from Stacyville to the Mattagamon, upon the slopes the road has been washed till, after the lapse of years, little is left but rocks; and the track has been reduced by the washing to a lower level than the surface on each side, and so has become a channel for drainage. Twice the writer has passed over it to the river when water from recent storms was still running copiously, converting the road upon several long hill-sides into the bed of a shallow but rapid brook. Across the swampy valleys between the hills the road is corduroyed, and in '79 was so flooded that the slippery and decaying skids were often afloat. That even a pair of horses accustomed to all the impediments of the woods could draw the team-wagon, on which we rode, over such a way without disaster to themselves and the vehicle, would be incredible to us had we not seen the thing done. The time consumed in going this distance of six miles was above three hours.

Beyond the Mattagamon, rough wagons pass over the seven miles to the second Wassataquoik crossing; but beyond that our luggage was borne sixteen miles, to the mountain, upon

the backs of the party and of men hired to assist in the transportation. For the five miles to Ktaadn Lake, portions of the logging-road were in fair condition, but during the years since the lumberers withdrew, a dense growth of bushes had sprung up at intervals, and trees had fallen across the way at all possible angles. This year we found the road bushed and cleared of windfalls, nearly to the lake; and on our return, after sixteen days' encampment in the Basin, the road had been so far improved, for the purpose of taking supplies to a crew of men who rebuilt the outlet-dam during our stay at the mountain, that a later party had been able to convey their baggage to the lake upon a jumper, which we, having attempted to use, had been obliged to relinquish after a mile or two.

From the outlet of Ktaadn Lake the road skirts its southern shore and continues, with the usual bush-grown and swampy intervals, about four miles, when suddenly plunging down a steep pitch to Sandy Stream, it turns north, follows the stream a mile and a half, and then abruptly ends at Reed's Upper Dam. Never well cleared, but left originally full of stumps, logs, rocks, and holes, the way upon the shore of the stream is now throughout densely grown up to bushes, which hide from sight the footing; so that the heavily laden traveller must stumble blindly along, over the obstacles already named, as well as upon many slippery and rotting corduroys. This terminal part of the road, along the stream, is the sorest trial of the whole route, and will not soon be improved for use in lumbering operations; for although these are to be resumed the coming winter upon the upper Wassataquoik (to flood which in the driving season the Ktaadn Lake dam has been renewed), there are at present no inducements to attempt lumbering upon Sandy Stream. At the end of the road the stream is crossed upon the ruinous Reed's Dam, and the rest of the journey is made along a spotted line. This trail is better and easier than the overgrown road; but from its beginning one must consider himself to be already upon the mountain, since in the five and a half miles thence to the Basin there is a rise, almost constant, of 1,700 feet, or 309 feet to the mile. For the last two

miles, from the lowermost of the three little Basin-mouth ponds into the Basin itself, the whole way is over ridges composed of blocks of granite from the mountain, all the more tiresome because of the rapid ascent.

During the present year a change has been made in part of the old route. Mr. S. B. Gates, the enterprising and gentlemanly proprietor of the Winn and Mattawamkeag hotels, having bought the Hunt Place, its former occupant, Mr. C. R. Patterson, has removed to the deserted Dacey clearing, — the only one except Hunt's upon the river for many miles, and a mile and a half above that, — and has there built himself a house. Although Mr. Gates has repaired the Hunt buildings, they have stood unoccupied through the season. As a consequence, all the travel connected with preparations for the winter's work on the Wassataquoik, and the travel to the mountain — more than the average for the route — have been turned over the rough road which Mr. Patterson has opened from Hunt's to his own place, and his house has been filled with wayfarers. As it is farther up the Mattagamon than the mouth of the Wassataquoik, a crossing of the river here saves one of the two over the stream, — a thing of importance enough to insure the continuance of travel that way; which is not to be regretted by visitors to Ktaadn, since they can make their selection between two places of entertainment on the way.

Another deviation at this end of the route, not hitherto often made, — but as travel increases, likely to become more common for the sake of variety, — is a trip by boat down the Mattagamon to Medway, twenty-two miles below Hunt's. We tried this in September last on the return from Ktaadn. The river is strikingly beautiful. For much of the thirty miles, over which we have boated, to its mouth, it has shores clothed to the water's edge with stately hard-wood forest. Except the two already mentioned, there are no clearings along the banks farther than three or four miles upwards from Medway. As usual with Maine rivers, the water is alternately sluggish and "strong;" but the rapids, including the worst, the Whetstone and Grindstone falls, were run by the loaded bateau at the medium stage of water prevailing

when we made the descent, which occupied ten hours of actual running. The upward passage requires double that time. Not a glimpse of Ktaadn is seen in boating the whole length of the Mattagamon; and, *vice versa*, not a square rod of the water of that river is discernible from Ktaadn; though the main Penobscot abreast of Medway, a few rods below the junction of the rivers, is visible from the mountain.

The projected lumbering upon the Wassataquoik promises to make Ktaadn again accessible from a quarter by which in former years a few approached it. Logging-roads opened into that region will make it possible to ascend the mountain at its northern end, as did Rev. Edward Everett Hale and his friend Mr. Channing, in 1845, — an account of whose excursion was published in the Boston Advertiser on their return. As in the cases of Bailey, Thoreau, and Winthrop, rain prevented them from reaching the basins and the higher summits.

The northern slopes have been represented as less abrupt than those on the south, and the ascent from that direction as therefore least difficult. Mr. Hale, on the contrary, found them very abrupt. A recent two days' exploring trip from the Great Basin over the northern ridge and down one of its terminal spurs, followed by the crossing of several others on the way to and around through the valley between Ktaadn and Turner Mountain, back to the Basin, convinced the writer that the slopes of the north are hardly less steep than those of other parts. From the smaller elevation of the north mountain, its slopes are of course shorter than those of the higher south mountain; but to ascend by way of the northern extremity requires several miles of extra travel to reach it, and a return upon the ridge as far to the south before the basins and chief peaks can be attained, — to say nothing of the almost impenetrable scrub which must be encountered at certain levels. Above all, another difficulty renders the northern ascent unadvisable, — the same as that which in less degree is inseparable from ascent by the East and Southwest slides, — namely, the necessity of camping at so great distance from the summits that the visitor is forced to

be content with only a few hours upon them, and to make a hasty departure, ordinarily without descending into the Great Basin — the grandest part of the whole mountain. It cannot be too strongly insisted that it is only upon the floor of the Basin, — a central point, in the very heart of the mountain, a little more than 2,900 feet above the sea and not quite 2,300 feet lower than the highest peak, — that a camp can be placed and supplied which will allow of daily ascents and returns, to and from the greater heights and in all directions. For those who visit Ktaadn with the desire really to study and comprehend it, the fact that the fourth, or eastern, route is the only convenient way of access to the Basin is its sufficient recommendation. When it shall be opened by a good road it will be preferred, too, by the majority of visitors, for its exemption from the exposures and fatigues incident to the water routes, which, — and especially that by way of Moosehead Lake, — will always be favorites with persons to whom hunting, fishing, and adventure are the chief attractions of the region, and with whom the pleasure and excitement of canoeing and rapid-shooting outweigh the attendant dangers. Measured from points where public conveyance ends, this route is the shortest, the distance from Sherman into the Basin being thirty-three miles; while the lengths of the others, to the mouth of Aboljacarmegus Stream, nine miles from the chief summit, are as follows: of the first, from Medway up the Penobscot, forty miles; of the second, from Brownville Village *via* the Joe Merry lakes, forty-seven miles; of the third, from Moosehead Lake at the Northeast Carry, about fifty-five miles.

A glance at the accompanying map[1] will show that the shortest highway which can be constructed to Ktaadn from any district now inhabited, must start from Sherman or from Patten, nine miles northwest of Sherman. Under existing circumstances the southernmost point of departure will be preferred, not only as saving several miles of travel, but because by taking the direction of the logging-road up the Wassataquoik and Ktaadn streams, the highway would approach the mountain by the most favorable course. Should a railroad be built from Houlton to Patten it would not

[1] Plate IX.

touch Sherman, and the coming highway[1] might start direct from Patten to Ktaadn; but any railway to Patten from Mattawamheag, as the one contemplated by the directors of the Maine Central Road[2] and now being surveyed, must follow the valley of the Molunkus Stream through Sherman, which would then, as now, be the natural starting point to Ktaadn.

In the twelve miles of logging-road between the Mattagamon, at the Hunt Place, and Ktaadn Lake, there is an increase of elevation of 700 feet, without difficult hills. Of this increase the greater part, 500 feet, occurs in the five miles between the second [illegible]

[illegible] Lake, which is a beautiful sheet of water, from two to three miles long and half as wide. On the west Ktaadn rises majestic. To the northwest, and near at hand, lies Turner Mountain, a notable feature in the landscape, — named, not as might be supposed from Charles Turner, the original describer of Ktaadn, but for the man who first cut timber in the vicinity of the elevation which now bears his

[1] The opening of which is being seriously considered by several energetic men. Appeal to the State Legislature will be made for help in the enterprise, — not with flattering prospect of success, it is to be feared, judging from the past.

[2] See note on inserted slip.

be content with only a few hours upon them, and to make a hasty departure, ordinarily without descending into the Great Basin — the grandest part of the whole mountain. It cannot be too strongly insisted that it is only upon the floor of the Basin, — a central point, in the very heart of the mountain, a little more than 2,900 feet above the sea and not quite 2,300 feet lower than the highest peak, — that a camp can be placed and supplied which will allow of daily ascents and returns, to and from the greater heights and in all directions. For those who visit Ktaadn with the desire really to study and comprehend it, the fact that the fourth, or eastern, route

[*To face page 329.*]

The proposed extension of the Maine Central Railroad, as originally announced, was to pass from Dexter *via* Dover and Brownville through the forest to Mattawamkeag, and thence to Patten and the terminus at Presque Isle. A more recent report is that the route now under survey avoids Mattawamkeag, striking the Mattagamon some six miles above Medway, and running direct to Sherman and Patten. Should this course be followed, the highway to Ktaadn will probably begin from a station near the crossing of the Mattagamon. But it seems improbable that a railway will actually be constructed through so many miles of wilderness, destitute of population or resources of any kind for the support of a railroad.

A glance at the accompanying map[1] will show that the shortest highway which can be constructed to Ktaadn from any district now inhabited, must start from Sherman or from Patten, nine miles northwest of Sherman. Under existing circumstances the southernmost point of departure will be preferred, not only as saving several miles of travel, but because by taking the direction of the logging-road up the Wassataquoik and Ktaadn streams, the highway would approach the mountain by the most favorable course. Should a railroad be built from Houlton to Patten it would not

1 Plate IX.

touch Sherman, and the coming highway[1] might start direct from Patten to Ktaadn; but any railway to Patten from Mattawamheag, as the one contemplated by the directors of the Maine Central Road[2] and now being surveyed, must follow the valley of the Molunkus Stream through Sherman, which would then, as now, be the natural starting point to Ktaadn.

In the twelve miles of logging-road between the Mattagamon, at the Hunt Place, and Ktaadn Lake, there is an increase of elevation of 700 feet, without difficult hills. Of this increase the greater part, 500 feet, occurs in the five miles between the second Wassataquoik crossing and the lake, and the rise is nearly uniform and almost literally without a hill. For the next five and a half miles, to the crossing of Sandy Stream, there is little or no change of elevation. No great inequalities of surface, then, exist to swell the cost of a road over this part of the route, nor is the ground swampy beyond the average of the region; but, as before remarked, in the last five and a half miles from Sandy Stream into the Basin, the ascent is almost constant and generally rapid. It seems probable, therefore, that the first step towards "opening Ktaadn to the public" will be to construct a stage-road from Sherman to Ktaadn Lake, to build a hotel upon a beautiful site a mile beyond the outlet, and thence to establish a bridle-path into the Basin, a cabin being provided there as a shelter for visitors. Later will come a hotel in the Basin, with foot and bridle paths to the summits.

It will be difficult to find in New England a more delightful site for a summer resort than is afforded by the south shore of Ktaadn Lake, which is a beautiful sheet of water, from two to three miles long and half as wide. On the west Ktaadn rises majestic. To the northwest, and near at hand, lies Turner Mountain, a notable feature in the landscape, — named, not as might be supposed from Charles Turner, the original describer of Ktaadn, but for the man who first cut timber in the vicinity of the elevation which now bears his

[1] The opening of which is being seriously considered by several energetic men. Appeal to the State Legislature will be made for help in the enterprise, — not with flattering prospect of success, it is to be feared, judging from the past.

[2] See note on inserted slip.

name. Beyond the lake, in the north, some twenty miles away, the Traveller, a mountain of fine outlines, terminates the view.

The fourth route, furthermore, presents Ktaadn on what the artist Church has styled its most "pictorial" side. It is only when seen from the east that Ktaadn assumes the conical shape which early associations assign to the ideal mountain, since the sketches on which the child's impressions are formed are usually end views of mountain ridges. Except at one point, in the town of Lincoln, the mountain is not visible from the railway between Bangor and Mattawamkeag; nor is a glimpse of it gained in the stage ride to Sherman, till a hill is mounted near the line between township Number One and Benedicta. From Forty-one Hill, in the last named town, there is a superb view of Ktaadn,[1] which far surpasses any other distant prospect of it known to us. The outlook is across a deep valley, and takes in the southern (highest) mountain from the very base to its loftiest peak. Other fine views are to be enjoyed from Kelly and Stacy hills, on the road through Stacyville. On the way from the last named hill to the Basin, twenty-nine miles, the mountain is invisible, except from Patterson's house and the hill behind it, from Ktaadn Lake, from the crossing of Sandy Stream, and from a ridge at the edge of the little mountain bog, crossed by the trail two and a half miles outside the Basin. The views from Ktaadn Lake and the little bog are emphatically grand. Another from Palmer Hill, two miles south of Patten, on the road from Sherman, is said to be one of the best; but of it the writer can speak only from hearsay, having seen the mountain thence only when it was partly obscured. A nearer and admirable view, from the same direction as the last, may be had from the top of the easily accessible Lunxus[2] Mountain, situated six miles north from

[1] "The best mountain in the wildest wild to be had on this side the continent." — Theodore Winthrop, "Life in the Open Air," p. 59.

[2] Pronounced by woodsmen as if spelled *Lunk-soos*, of which they give as the English equivalent the epithet "Indian Devil." The name refers to a wild beast, real or imaginary, which was the terror of the northern aborigines, — supposed to have been the Panther. Thoreau spells the word *Lunxus*.

Patterson's, on the west side of the Mattagamon, and rising 1,425 feet above it, as measured with the aneroid.

After many inquiries addressed to guides and residents along the different routes, we judge that the number of visitors to Ktaadn, by all the routes, for the last ten years has averaged less than fifty per annum.[1] Ordinarily more have gone by the route down the Penobscot from Moosehead Lake than by any other; the next smaller number have chosen the one up that river from Medway; while, as before stated, fewest have taken the Brownville route. The sum total for all routes varies of course from year to year, as does the number for each route. Thus in 1879 only eight visitors, exclusive of guides, went by way of Sherman; but in 1880 thirty persons took that course, of whom, however, twenty-six went from Patten in one party, the first which for years had made the trip from that town, there being no road from it through the woods to Ktaadn. The same year excessive drought rendered the Penobscot so difficult for boat navigation, that probably not more than a dozen tourists chose the three routes of which that river makes a part. Again, the present year more than the usual number have gone by way of Sherman, while fewer than the average have followed the river routes.

The Showiest Butterfly of Glen Ellis (Basilarchia Arthemis).

BY SAMUEL H. SCUDDER.

Read at the Field Meeting at Jackson, N. H., July 19, 1881.

I WISH to call the attention of the Club to-day to the Banded Purple (as Gosse calls it), one of the most attractive butterflies the members are likely to see during their visit to the mountains, — a large, deep purple or blue-black insect, with a broad white bow stretched across the wings. It has

[1] Of the two proprietors of the main mountain, Bangor gentlemen, neither has ever ascended it.

been a special favorite of mine ever since, in college days, it first gladdened my eyes in the depths of the Greylock Hopper, by Williamstown, and it is nowhere so abundant as in the shady forest-roads of northern New Hampshire. Here, where we hold our meeting to-day, is its true home.

Twice during the year it runs the cycle of its changes, appearing on the wing at remarkably fixed epochs. Perhaps this year, with its unusually tardy development of vegetation, may be exceptional, but as a general rule its first appearance here is between the sixteenth and twentieth of June, and its second late in August. At the present moment you will be able to find butterflies, eggs, and young caterpillars. The butterflies will be battered and torn, or at least will not be perfect, though their rich colors may be undimmed; for though they are less upon the wing than most butterflies, they are unusually active when alighted; and being also very social in their habits, the constant movement of the wings, and the restless change of posture, as of an uneasy, nervous child, abrade the delicate plumage and the soft membrane of the wing, when only two or three days from chrysalis. You will find them collected about the damp spots in front of the water-troughs on the highway, or by the relics of the last rain in the ruts of the shaded road.

The eggs of this butterfly and of its congeners (of which I shall shortly speak) differ from all known eggs of butterflies, in that the external fretwork of cells, common to many species, bristles with little spines or filaments. A curious fact in their natural history is that they are laid on the under surface of the extreme apex of a leaf, one egg to a leaf, and that those leaves are chosen which have a remarkably tapering tip, aspens and willows, and in the case of our Banded Purple, the black birch. A few days suffice for this stage. As soon as the little caterpillar has gnawed its way out of its prison and devoured its prison walls, it begins to eat in a curious way the leaf on which it rests; it nibbles away either side next the tip, leaving the midrib untouched, and attaches to it, next the uneaten portion of the leaf, a little cluster of leaf fragments, loosely connected by silk, and which, as the leaf is eaten away, it transfers farther and farther toward the base. After

each meal it crawls upon the stripped midrib, and remains motionless until hunger again tempts it away. Thus it remains on the leaf on which it was born until this is quite devoured. It has now grown much larger, and moulted at least once; and when it deserts its cradle for richer pastures, it is less particular in its method of feeding, although still showing a tendency to the same habits, usually eating a leaf from the tip backward, and invariably taking its siesta upon a twig rather than on a leaf.

About the middle of August the caterpillars now feeding will be rapidly changing to chrysalis, and in ten or twelve days afterward the butterfly will again be on the wing, and the cycle recommences; yet not to follow the same course, for winter intervenes, introducing a new element and an alternation of habits in the two generations. When the caterpillar of this brood is still very small, it folds together the opposite edges of a partially eaten leaf, forming a nest, which it lines within and without with brown silk, and attaches the stalk of the leaf itself firmly to the twig by a similar coating. Into this cylinder, closed at the base and just large enough to receive its body, the caterpillar crawls head foremost, and hibernates; its tail is beset with spinous tubercles sufficiently guarding the only exposed part of the body; and here it remains until early spring, when with the bursting leaf it forsakes its nest to break its long fast.

Up to this time it has never left the twig on which it was born; and it is a curious instinct which teaches the mother of at least this brood to lay eggs exclusively on young and tender shoots of birch, not more than two or three feet above the ground, where, covered with the deep snows of this region the winter through, the young caterpillar escapes the excesses of temperature which otherwise might well prove fatal. That this is the case, an examination in the Glen one spring, of over five thousand birches, left no doubt; and it also brought to light a remarkable resemblance, both in form and color, between these hibernacula, or winter nests of the caterpillar, and the bursting buds of the birch. That this may be one of the many instances of protective resemblance which we find in nature may well be believed, when we recollect how active

and numerous at just this season are the ichneumon parasites of caterpillars; and we also know that our Banded Purple is not altogether exempt from their ravages.

The history I have now given does not agree with Edwards's account of the insect. He would make it out single-brooded, having never seen or heard, apparently, of the September butterflies; and so it probably is, in the southern part of its range, for all the butterflies taken south of this region of their abundance have been of the first brood. That they have not flown thither from these northern parts is proved by their usually greater size.

The genus to which this butterfly belongs is peculiar to Eastern North America, and is represented by several species. One, *Basilarchia Weidemeyeri*, very similar to our Banded Purple, but differing from it, among other points, in the greater breadth of the white bow on the wing, is found in the Rocky Mountain region. East of the Rocky Mountains, in the northern parts of the country, including, in the United States, only the northern tier of states, our Banded Purple has its home. South of this is found another species, *Basilarchia Astyanax*, differing from those previously mentioned in altogether wanting any white band, and its northern limits coincide very closely with the southern boundaries of the Banded Purple. Within recent times we have become acquainted with another form, *Basilarchia Proserpina*, at first considered a distinct species, but afterward believed to be a variety or dimorphic form of either the northern or the southern species. In truth it varies so widely that some specimens can scarcely be distinguished from the Banded Purple; while those at the opposite extreme, grade insensibly into the southern species. That it is really nothing more than a hybrid between the two these peculiarities render probable, as well as the additional fact that it only occurs in certain hilly localities on the common boundary line of the two species. The question of its relationship may fairly be called an open one, and, until it is solved, the history of our Banded Purple cannot be considered complete.

There is still another species of the genus, more widely spread than any of the others, covering indeed the common

ground of all of them. In its earlier stages this butterfly, *Basilarchia Archippus*, can scarcely be distinguished from the others, even by an expert; indeed the eggs, caterpillars, and chrysalids of all the species of this genus are wonderfully alike, and there can be no doubt in the minds of those who hold to the derivative theory of species that they all originally sprang from a common ancestry; but, in its perfect stage, this butterfly differs completely from its allies, being of an orange-brown color, margined and veined with black; the purple of the other species is altogether absent, and in place of the dottings and flushes of metallic blue which lend such richness to the markings of the others, there is nothing to be seen but a few white dots upon a dead-black ground. Even the pattern of the coloring is thus essentially altered. What explanation can be offered of such a strange difference? Roaming over the same field, we have a large and showy butterfly, the Monarch, or Milk-weed Butterfly, *Danais Plexippus*, double the size of our Basilarchia, but with exactly the same coloring and, but for the curved black line which crosses the wings of this, with exactly the same pattern. This showy insect belongs however to an entirely different group of butterflies, — a group, moreover, which in the tropics of both worlds is mimicked by weaker brethren, who thus masquerading in borrowed livery, hope for the exemption from enemies which their betters seem to enjoy. This at least is the only rational explanation that has as yet been offered of mimicry in pattern and color among butterflies; and its application to the species we are now considering is rendered all the more reasonable from the curious fact that in Florida and Texas, where our showy butterfly is replaced by another species of the same group, of a darker mahogany tint, the colors of our Basilarchia turn also to mahogany.

You will acknowledge then that the history of our Banded Purple and its relatives is of no mean interest. Study of the histories and markings of these different species leads moreover to the conclusion, the reasons for which there is not now time to give, that our Banded Purple, more nearly than the others, represents the life and appearance of the ground-form from which all are descended, and this warrants their mention in this connection.

We might indeed go one step further, and call attention to a very closely allied genus, *Limenitis*, having representatives upon the Pacific Coast and over the northern part of the Old World, the habits of whose caterpillars are almost identical with those of our genus to the uttermost detail. An examination of the life-histories and structure of these two genera renders it extremely probable that all their members had a common origin in the still more distant past. Indeed, so interwoven are the threads of life that the subject enlarges on many lines from whatever point it may be viewed, and it would be easy to show that the study of any single butterfly leads at once to questions of the largest interest and of the profoundest philosophy.

The March of Captain Samuel Willard.[1]

By Charles E. Fay.

The readers of Appalachia can hardly fail to accord a warm welcome to the following interesting journal of Samuel Willard's scouting-party, which in its journeyings must have traversed the middle or southerly section of the White Mountain wilderness, from the Pemigewasset River to the Saco, in the autumn of 1725. First, because it is a somewhat full and specific record of perhaps the earliest visitation by white men of a section which to-day offers so many attractions to tourists and explorers; while at the same time, its pages offer much that is enigmatical, even to those who can claim considerable familiarity with the greater part of the country which this little "army" must have passed through. Secondly, by reason of the circumstance which brought it afresh to public notice in the year 1876. The entry for Wednesday, the 6th of October, was cited in evidence in the discussion of the vexed question regarding the true name of the northern Kearsarge.[2] Again, one cannot fail, in the light of a com-

[1] For information concerning Captain Willard, — afterwards Colonel, when he won distinction twenty years later in the old French and Indian War, — see the History of Lancaster (Mass.) by the Rev. A. P. Marvin, pp. 173–174, 220–224.

[2] See Appalachia, Vol. I. pp. 154, 159–161.

pleter knowledge of the locality and with a superior education in mountain-craft, to scan with interest the unsophisticated record of these dwellers in the lowland, making their blind way through an unknown wilderness, beset with dangers no less than hardships. The amazing exaggerations in the estimate of their day's-marches and of the heights they toiled over affect us almost ludicrously, and at times would cast a shadow upon the veraciousness of our warlike explorers, had not the judgment of each of us, before many a visit to the mountains had educated it, been often found at fault in its decisions.

This was no pleasure party. Though a bloodless campaign, as it proved, none knew how soon the silence of the forest would be broken by death-shots. We find no trace of any delight or awe at the grand or beautiful scenes amid which they were passing; not in statement, for that would have been out of place in a journal of the sort; not even by implication, by reflected color in the style of the scribe. There is only the toil of the day, the careful defence against the dangers of the night; for hints of scenery, only the tributaries forded, the wooded slopes scaled, the arable intervales, the "still stream fit for canoes." It is the colonist who, while he stealthily pursues the doomed foe of advancing Civilization, notes and treasures in memory only those places that may afford her the best foothold.

The riddle of this journal awaits its solution. When set in evidence in the discussion alluded to, it was supposed that the party ascended the Pemigewasset to the East Branch, followed the latter to its head, and, proceeding over the Willey range, struck the Saco at the head of the Notch. The committee of the Club, in collating the evidence, found so many items militating against this interpretation, that they brought forward a new one, in accordance with which the party must have left the Pemigewasset before reaching the East branch, crossed the Oscèola range to the Hancock Branch, and made its way hence to the head of what is now known as Swift River, a branch of the Saco. Even under this rendering, which removes so many of the contradictions of the former one, many points remain to be elucidated, par-

ticularly in the record of the daily journeys from September 30 to October 6. Perhaps some may be inspired to go, record in hand, over the same route as nearly as possible. Shall we have as many theories advanced as to the line of this march, as there have been with regard to the pass chosen by Hannibal in his passage of the Alps?

I have given in foot-notes the present names of some of the well known localities mentioned in the text, and have also ventured to suggest an identification of some of the points noticed in the then unfrequented district. In the latter cases a mark of interrogation follows the name. My suggestions would seem to betray a profound ignorance of the region, if the distances as estimated by the party were even approximately accurate. But it is safe to deduct one half, or even more, from these estimates, from the time they left the confluence of the two rivers which form the Merrimack, until they came to Pigwacket (Fryeburg). This will be conceded, if one accepts their record after they had come to the head of Saco River, as a criterion. Allowing that it was the Saco of to-day which they found, and that their march was directly down its course, the distance to Fryeburg would be hardly more than forty miles. By the railroad it is thirty-eight miles from the Crawford House to Fryeburg station. By their record the distance made is eighty-two miles. If on the other hand it was, as we are compelled to believe, the Swift River which they followed, a liberal estimate would give it a length of twenty miles; but they reckon it sixty!

Additional evidence of their false judgment in the matter of distance is found in the two estimates of elevation. In both instances their estimate of the angle of slope, which is naturally much less subject to error, is not exaggerated. It is only when these slopes are continued for excessive distances that one attains excessive elevations. Two miles in five (Oct. 1) speaks for an angle of only twenty-three and a half degrees. A fall of five feet in thirty (Oct. 3) is equivalent to a slope of but nine and a half degrees; yet continued for eleven miles it gives a fall of a mile and eight tenths!

Among the most difficult points to determine are the identity of the "Sowhaig River" (Sept. 25), to which the

Indians made a portage from Pemigewasset, and that of the "great mountain on the west side of the river" (Sept. 29), nearly opposite which the party left the stream and laid their course eastward over the mountains.

So far as I know, the name "Sowhaig," appears on no map, the nearest approximation being the Souhegan, in Hillsborough county. This cannot be meant, but something to the northeast; for it was while advancing along the line of the carry that Squam Lake was reached. It will be noticed also, that "Pemigewasset" is not the river of that name, which is constantly called "Merrimack" in this document, but a region. The same is true of "Ossipy" — a fact which bears upon the interpretation of the names "Winnepeseockey" and "Pigwacket" in Willard's earlier journal.[1]

The present journal is preserved among the archives of the State of Massachusetts [38 A]. So far as I am aware, it has never appeared in print. It covers two pages and a half of foolscap, and is carefully written (copied on the return, doubtless, from notes taken on the march) in a clear, legible hand. The edges are considerably worn and discolored, as likewise the creases of the original folding, as if it had lain long in the file. The attempt has been made to produce as nearly accurate a copy as a transfer from script to type will permit. The italics are emendations made, apparently, by the author.

A Journal of yᵉ March of Capᵗ Samuel Willard accompanied with Capᵗ Jos: Blancher In pursuit of yᵉ Indian Rebells, Begun & Musturd at Lancaster friday Sepʳ yᵉ 3ᵈ.

1725.	
Sepr 4ᵗʰ Saturday	Leivᵗ Warner marched wᵗʰ all said Willards Company to Groton except those of Lancaster.
Sabbath. 5ᵗʰ	Lay still by reason of Rain.
Mund 6ᵗʰ:	Capᵗ Willard & those of Lancaster Rid & overtook Lᵗ Warner & yᵉ rest at Dunstable.[2]

Tuesday Wednesday & thursday Lay still by reason of hard rains.

[1] See APPALACHIA I. pp. 154–155. [2] Nashua.

Friday 10	We marched over ye River about 7 mile & campt.
Saturday 11th.	We marched up ye River to Parkers Brook & campt.
Sabbath 12th	We lay still by reason of Rain.
Munday 13	We marched up ye River to Neticoock[1] & campt.
Tuesday 14	We marched up sd River to Cohasset falls[2] & sent out scouts, & campt.
Wednesday 15	We marched to Ammoskeeg sent out scouts & campt.
Thursday 16.	We sent a scout consisting of 40 men over ye River wch marched on ye West side. Capt Blancher went to Hannihoockset falls[3] & campt, & Capt Willard went to Suncook about 3 mile further & campt.
Friday 17	We marched to Pennicoock Lower[4] falls & Capt Willard & Compa went over On ye West side of ye River, & marched to Pennicoock upper[5] falls & campt. This day Capt Blancher saw some shoe tracks, & having gone up to Peñicook old fort[6] found where they campt, & supposed them to be scouts sent out from New Hampshire Governmt & sd Capt campt a mile above ye fort.
Saturday 18	We marched about 3 mile above Contocock River & there Capt Blancher came over to ye West side of ye River, sent out scouts, & campt.
Sabbath 19	ye Captains agreed to send back a parcel of Men & took their Provisions vizt out of Capt Blanchers Compa 28 Men, out of Capt Willards Compa 15 Men; in all 43 Men under ye Comand of Leivt Comes: two of Capt Willards men being sick viz Abel Chapin had a Feavr & Benja Atherton the Bloody Flux, & Richd Burck cut his leg with a hatchit wch Disinabled him for ye service, being also one of Capt Willards Men and all in included in ye said number of 43 men.

[1] Naticook Brook flows into the Merrimack from the west, in the town of Merrimack.

[2] Goff's Falls. [3] Hooksett. [4] Garvin's Falls (?).

[5] Sewall's Falls (?).

[6] On Sugarball Hill, opposite the city of Concord.

Munday 20	We marched to ye Crotch[1] of ye River wch is about 70 miles from Dunstable and crossed ye West Branch,[2] sent Out scouts, & Campt.
Tuesday 21	We marched toward Pimiwachet,[3] alias Pemissiwasset about 11 miles, and sent out scouts, & Campt.
Wed 22	We marched about 9 mile & sent out scouts & campt; this day Barna Davis Cut his foot with a stone.
Thursday 23	We sent out scouts to ye River and up by ye side 4 mile, & ye army by reason of Rain lay still.
Friday 24	Capt Willard sent back 11 of his men & of Capt Blanchers 8, which made 19 Some of wch was sick viz of Capt Willards men Jona Adams Ebenezr Polly of a flux, & Symon Atherton ye feavr & ague, & said Davis wch cut himself The Captns ordered them to take one Conoe from ye crotch of ye River where we had left ye rest, & ordrd ye rest shou'd be left for fear of anymore sickness. After this marched about 6 mile & come to ye River, & sent out scouts, & campt.
Saturday 25	We marched about 6 mile & came to ye carrying place, where ye Indians carry their Conoes from Pimichiwasset to Sowhaig River; and found that ye Indians had lately been there & carried their Conoes: Capt Willard took half a scout of his own & half of Ct Blanchers being in all 24 & followed ye Indians and a little before we come to Cusumpy Pond[4] we found where they brook one Conoe & Coming to ye Pond cou'd follow them noe further: in ye mean time Leivt Warner with 24 men out of both Companies scouted up ye River, & returned about ye middle of ye afternoon, & ye army being all met marched about 2 mile up ye River and campt.
Sept 25	Saturday we also Examined Jos: ye Mohak (taking Nessa Gawny for an Interpreter) which was the best way to goe to ye fort he told of; and he said we must goe up to ye head of merimack because

[1] Confluence of the Pemigewasset and Winnipiseogee rivers.

[2] Pemigewasset River.

[3] The country about Plymouth (?).

[4] Squam Lake.

there was noe goeing over y^e hills nord Cusupy Ponds.

Sabb^t 26 — We marched about 12 mile up ye River & sent out scouts & campt.

Mund. 27 — We marched about 12 mile and crossed A stream[1] which ran from y^e Hills where Cap^t Lovel killed y^e first Indian last winter & sent out scouts & campt.

Tuesday 28 — We marched about 12 mile up y^e River & in about 3 mile found a large Wigwam where y^e Indians had lately been, as we judged about 20 in number, and our Indian said there was Squaws as well as Sannups, We tracked some of them as we suppose towards Ossippy, and some up y^e River, towards night we crossed a stream[2] of some considerable bigness & sent out scouts, & campt.

Wednes. 29 — We marched up y^e River about 14 mile, & come this day to y^e foot *of* a great mountain on y^e west side of y^e River, where y^e stream was small, we tracked Indians all this day which we suppose ware gone directly to Canada, the mountains being steep & rocky we cou'd not track them further. This morning We see where they had been about a week before (we supposed) built a Conoe, & judged them to be, them which we had trackd from Pimichiwasset to Cusumpy Pond & there campt.

Thursd. 30 — In y^e morning sent a scout of 20 men about 4 or 5 mile up y^e River who made noe farther discovery, after that we left y^e River & steared East *about* 3 *ms* up a very steep mountain[3] & campt by reason of Rain; having this morning Examin'd Jos: (y^e Mohauck) and he said he did not know them woods, and did not think that y^e head of Merimack had been so fur up, & cou'd tell nothing without he found Sawco River.

Friday Octo^r 1^st — We marched up y^e same hill about 6 mile, and being on y^e top of y^e hill cou'd Discover no where nigh us, *anything* but steep mountains, & marched down y^e hill about five mile, & we generally judged said 5 mile to be 2 mile on a perpendicular. there campt by a small brook w^ch ran out of y^e mountain.

[1] Beebe's River (?). [2] Mad River (?).
[3] Some part of the Osceola range (?).

Saturday 2d — We lay still by reason of rain, but sent out some scouts who discover'd *Merimack*[1] ran from ye S? E! round said mountain.

Sabbath 3 — We marched S. E. up said River about 6 mile & came to ye head of it, & then steared N. E. about 3 mile *over* a steep hill & then came to ye head of Sawco River[2] and then marched down said River about 11 miles East & we judged that River all yt way had fall 5 foot in 30 & mountains on each side thereof Sent scouts down ye River and campt.

Mund: 4 — This Morning Examin'd sd Mohack, & said he cou'd tell nothing 'till he came lower down ye River. We marched down said River about 5 Mile & sent out scouts, & campt by reason of rain.

Tuesday 5th — This morning we came on some Entervalls & plain land, & found where Indians have been in ye Spring, having found ye hoops whereupon they Dried their Beavr Skins, & we judged might be about 8 or 10 in Number. this Day we judged we marched about 24 mile, & sent out scouts, & campt.

Wednesd. th6. — We marched down ye River about 20 mile to ye place where Capt Lovel first came upon Sawco River 2 days before his fight at ye mouth of a stream which he followed from Pigwacket hill, Sent out scouts, & campt. We discovered a River[3] yt come from ye N W. into Sawco River.

Thursd. th7: — We Exd said Jo. ye Mohaauk whether that was not ye stream, whereupon the fort was, who said he coud not *tell* whether it was that, or one lower, Capts Willard & Blancher took said Jo. with 30 of ye Ablest men & scouted up said N. W. branch about 10 mile, & found it to be a still stream fit for Conoes with plenty of Enterval, & old planting land of ye Indians, and cou'd not learn anything from said Jo. & at night returned to ye Army. Perceiving Provisions to be short, thought it advisable to stear homewards.

Friday 8 of Octobr — We marched about 6 mile down ye River, & Having campt by reason of Rain sent scouts down ye River.

[1] Hancock Branch (?).

[3] Swift River (?).

[2] The Saco of to-day, above the confluence with Swift River (?).

Saturd. 9	We marched down ye River to Pigwacket old fort[1] about 16 mile, & Capt. Willard sent Leivt Warner out with Levt Wilder & 40 men from both Companies Into ye neck of ye River, & order'd them to meet ye army where Capt Lovil was killed. After meeting we marched to ye lower end of Sawco Pond[2] & sent out scouts, & campt by ye Rivers side. *in all about* 24 *miles.*
Sabb. 10	We marched about 26 mile & sent out scouts & Campt, & discover'd Ossippy River about a mile below us.
Mund. 11	We waded this morning sd River & marched about 20 mile down ye River, & sent out scouts, & campt.
Tuesday 12	We waded this morning over another River[3] & marched down Sawco River about 28 mile & came to Salmon falls,[4] sent out scouts & Campt below ye falls.
Wednes: 13	We marched about 13 miles & came into Sawco falls,[5] having no Subsistence we marched down to Winterharbour[6] 7 miles & took some provisions from Capt Jordan & lodged there.
Thursd: 14	It rained in ye forenoon & in ye afternoon marched to Cape porpus & there lodged. being about 7 mile.
Frid: 15	We came to Wels about 9 mile & lodged there & there parted wth Cap. Blancher, who went by Kingstown & Nutfield[7]
Saturd. 16	We came to Kittiry about 18 mile & lodged there.
Sabb: 17	We travilled to Hampton falls & lodged there about 20 mile.
Mund. 18	Came to Andavor being about 23 mile.
Tuesday 19	Capt Willard Rid & got home that night and ye rest of the men got home some wednesday some thursday & some friday being about 40 mile. So that from Lancaster In Capt Willards march accordin to his best judgment & agreed with by ye Compa being in *all* 503 mile.

℘ Benja Goodridge Clerk

[1] Near Fryeburg village.
[2] Lovewell's Pond.
[3] Little Ossipee River.
[4] Buxton.
[5] The present Biddeford.
[6] On Biddeford Pool.
[7] Londonderry, N. H.

Carter Dome, Huntington's Ravine, and the Montalban Ridge.

BY W. H. PICKERING.

MT. WASHINGTON, as viewed from the direction of North Conway, or better still from Mt. Kearsarge, is seen to be cleft on the southeast by three great ravines, — the Gulf of Slides, Tuckerman's, and Huntington's Ravines. The second of these is now well-known ground; the Gulf of Slides was explored in the summer of 1879 by Mr. W. S. Fenollosa and the writer, and an account of it has already appeared in APPALACHIA.[1] With Huntington's Ravine, however, we were quite unfamiliar, and the tales of the great height and steepness of its walls were very attractive to the alpine imagination. As far as we could learn, it had been previously traversed by only one person, Mr. C. B. Raymond, of Boston, and he had published no account of the expedition. We wished to ascend Carter Dome, and also to follow that portion of the Davis path (constructed in 1845) which formerly extended from Boott's Spur along the Montalban Ridge to the Giant's Stairs.

On the morning of Friday, September 17, we left the Intervale, North Conway, at 8.10, and drove to Mr. Davis's on the Carter Notch road, where we arrived in two hours. We wished to have some clearing done upon the summit of the Dome for topographical purposes, and therefore hired him to accompany us. The path leaves the right-hand side of the road three-quarters of a mile beyond his house.

The camp was reached at 12.10, and found by pedometer to be 5.25 miles from Davis's; elevation, 3,240 feet. Here we stopped for dinner, and then started up the mountain, leaving our packs behind us. The ascent begins from the further side of the larger lake, and is by a well-marked but exceedingly steep path. Twenty-five minutes after leaving the camp we came to a very fine view-point looking towards the south. It is the only level spot on the path, and is dis-

[1] Vol. II. p. 117.

tant two-thirds of a mile from the camp, and 735 feet above it. A short détour may be made just beyond this point to Pulpit Rock, a conspicuous overhanging ledge as seen from below. The trees were now rapidly becoming smaller, the path was growing less steep, and by two P.M. we stood on the summit. The time from the camp, deducting ten minutes rest at the view point, was just one hour; distance 1.5 miles, and elevation above the sea 4,830 feet. The summit is broad and flat, and covered with spruces about twelve feet in height, with thick, stout limbs. One of these we trimmed, so that it may be climbed about as readily as a ladder, and one person at a time may stand very comfortably in its top and enjoy the surrounding scenery.

Superlatives are too often used in the description of the views from mountain summits, thereby excluding comparison of their relative merits; but it may safely be said that there are few finer view-points for Mt. Washington than this.[1] In the first place, we are looking at it at right angles to its axis of greatest length; secondly, it is seen over a lower and intermediate mountain, which, however, permits us to look from near its base to its summit; thirdly, being on a high mountain ourselves, we must look downwards as well as upwards to take in its full magnitude; fourthly, its face is diversified by three of the finest ravines among the mountains, into the two southernmost of which we look directly; fifthly, the high mountains by which it is flanked are dwarfed by its greater proximity; and sixthly, Carter Dome being nearly due east, the shadows will be so cast during the middle of the day as to bring out the ravines and ridges of Washington to the greatest advantage.

A hole was drilled in a rock on the summit, and a cairn of stones four feet high erected; a line of trees twenty feet broad was then felled in the direction of Mt. Washington. This line was continued also in the opposite direction, so that as seen from Washington the cairn should appear on a sky horizon. An Appalachian bottle which we had brought with

[1] I must take exception to one or two slight inaccuracies in a former description of this view, APPALACHIA, I. p. 81. The summit of Wildcat is far below the lowest portions of either of the three great ravines. Neither the Great Gulf nor Mt. Clay is visible.

us was deposited, with proper precautions, among the stones of the cairn.

We left the summit at four o'clock, and in twenty-five minutes were in camp. My companion, who ran ahead, made the descent in twenty minutes. Ten minutes more brought us to the neck of the notch, and an hour and twenty minutes later we were at the Glen House.

The next morning we woke up to find a soft, gentle rain, with thick clouds hanging low on all the mountains. We were informed by a young man, evidently fresh from the city, that he thought it was going to clear up in an hour or two, — an opinion which we, as Appalachians, privately scoffed; nevertheless, he was right, after all. We left the Glen House at about half-past ten, bound for Conway, but had not gone far before the clouds rose out of the ravines so completely, that we decided, after a short consultation, to return and make a slight détour by way of the Mt. Washington carriage-road and the Raymond path to Tuckerman's Ravine, thence by the Club path to the Glen stage-road, and on to Conway. We had not much faith in the weather clearing off, but considered it a possibility. Even if it should, it would be very late at that season to start on an unknown walk of such magnitude as this promised to be.

The path, which is marked by a conspicuous sign-board, leaves the mountain-road near the two-mile post. Fifty minutes took us to the crossing of the Huntington Ravine Brook, and here a magnificent spectacle burst upon our gaze. Huge cloud masses were rising majestically through Tuckerman's Ravine, while the towering crags on either side appeared, if possible, even higher for their seeming aerial foundation. Near at hand a fine view was obtained of the rarely seen Raymond's Cataract, which, swelled by the recent rains, seemed almost entitled to its generic name. Large patches of blue sky were now visible, and it was evident that we could reach the top of the ravine unimpeded by clouds; and once past that point we cared little whether the summit was clear or cloudy, as we knew we could find it almost equally well, the distance and general direction of the carriage-road being known.

After a short consultation we decided to attempt the ascent. Our course, therefore, lay up the bed of the brook. The bed is quite narrow, and the brook was full; we were obliged, therefore, to keep along the banks, through some of the worst underbrush, exclusive of scrub and alders, that the mountains afford. After about a mile and a half of this, the monotony was relieved by a long slope covered with boulders, which were almost completely hidden under a growth of scrub spruce. Here we had to step carefully, to avoid the crevices between the rocks, some of them ten or even twenty feet deep, and which could only be avoided by carefully pulling aside the branches, and examining every foot of the way. Rising high above the rest were four large boulders, nearly in line, and about 100 yards apart. The largest was about thirty feet in diameter, and the others were not much less. The third of these we reached at two o'clock, one hour and fifty minutes from the path, having travelled in that time a little over a mile. Our elevation above the sea, according to the aneroid, was 4,220 feet. After stopping thirty minutes for dinner, we thought it would be interesting to know how fast we had been travelling for the last hundred yards or so. We accordingly laid off a distance of about 100 feet by the eye, and found that it required to traverse it just twelve minutes, which was at the rate of one mile in ten hours and a half. Fortunately this sort of walking did not last long, and we were soon relieved by smaller boulders and a growth of alders.

The clouds, which had shut down on us while at the boulders, now lifted and disclosed a magnificent view of the ravine from top to bottom. It is not so deeply cut as Tuckerman's, but may be compared to a huge chopping-tray, set up in such a position that one end shall be horizontal, the bottom quite steeply inclined, and the other end still steeper. It was this other end which we now had before us. The foliage had assumed its autumnal tints, and shone in variegated patches of green and gold against the rocky walls of the ravine. In front of us no less than six cascades, varying from 200 to 500 feet in height, were leaping over different portions of the precipitous wall. To be sure, none of them contained very

much water; probably the largest was not more than two or three feet in breadth, where it fell in a solid sheet; and this, compared with its immense height, gave it the appearance of a narrow white ribbon. This particular fall came down from behind a high conspicuous crag on the left, and we supposed that this was the one to which the name of Huntington's Cascade has been applied.

Several routes were now open to us, between which there seemed to be little choice; but we finally decided to keep as nearly as possible in the middle of the ravine, as this seemed fully as easy as any other, and brought us out nearer our destination. From this point, for an hour and a quarter, till we reached the sharply defined edge, we progressed on all-fours, and noted with what alacrity a haversack can travel from one's back to the rock on which he is about to put his knee. It was now five o'clock when we found ourselves at the foot of the Nelson Crag, just on the other side of which is the seventh mile-post on the Mt. Washington carriage-road. A few minutes sufficed to reach the latter, and at 5.40 we stood in the mists which surrounded the Summit House. Just before supper the clouds lifted, and on looking across to Carter Dome we perceived a small notch in its summit, hardly visible to the naked eye, and on procuring a glass recognized in a slight projection in its middle our cairn of the day before.

The next morning at 6.55 we started down the cone, striking the Crawford path at the old stables, and following it down to Bigelow's Lawn, where the Davis path branches off over Boott's Spur. We reached the slight col near the summit of the latter at 7.55, distance 1.5 miles. The path, which is clearly marked over the Spur, now descends sharply in a well-defined line through the scrub, but becomes much fainter in the spruces, and finally disappears. Davis told us that he had been over it seven years before, and that it was well marked for its full length by a second growth of deciduous trees. We found no such trees, but, according to his statement, Davis is probably the last man that went over it, and it is pretty certain that he will remain the last, for it has now ceased to exist, and the forests form an unbroken wilderness. The snapping of the dry branches, as we forced our way through

them, alone broke the deathlike silence which everywhere prevailed. Two hours and a half after leaving Mt. Washington we arrived at the first summit of the Montalban Ridge; distance three miles; elevation 4,370 feet. It is densely wooded, and no view is to be obtained. Leaving this point, we kept rather too far to the left in our endeavors to follow the path; but finding it useless we at length gave it up, and struck straight for the high nameless summit which so resembles Mt. Pleasant as seen from the Conway direction. From it a superb view of Mt. Washington and the southern side of the Clinton-Monroe Range was obtained. The time required from the summit was 4.05 hours; distance 4.5 miles; elevation 4,060 feet.

Just before reaching the next summit we came upon a lakelet on a rounded rocky knoll. It was exceedingly bad water and very warm, but we drank copiously, as it was the first found since leaving the summit. Future explorers will please note that just three yards beyond, under a high rock, lies a spring of most delicious ice-cold water. At one o'clock the second high bare summit was reached; distance 5.75 miles; elevation 3,900 feet. Here another fine view was obtained, which was also our last. Beyond lay three wooded hills, then a deep col containing a low summit, and then the Giant's Stairs. On the first of these hills we dined, then passing over the second we reached the third at 2.55 P.M., just 8 hours from the summit; distance 7 miles; elevation 3,620 feet. I will here remark that a mile an hour without a path corresponds approximately to four miles an hour on a good road. At this point the idea which had been gradually dawning upon our minds became a conviction, — that it was impossible to reach the Giant's Stairs and get out of the woods that night. There was one resource still left us, however, — to descend into the wilderness of the Rocky Branch valley, and follow the stream out to civilization. The slope was steep, and we had been walking fast most of the way, but we fairly ran now. At 4.15 we stood in the bed of the stream, having travelled 8.25 miles and descended to an elevation of 1,940 feet above the sea level.

We now had the brook-bed to follow, which, like all its

kind, seemed interminable. Before long we found that it was growing dark, and that walking must give place to running, if we expected to get out of the woods that night. We ran and ran. An hour passed on, and still nothing was to be seen, save the high ridges on either hand, clothed down to the very banks with thick black woods. Another hour passed by, and the situation began to look serious; we were tired of running, it was quite dark, and we could not be sure of our footing on the smooth rounded boulders. The brook looked exactly as it did two hours before, excepting that there was now more water in it, and we wet our feet more frequently. But everything must have an end, even a White Mountain brook, and after 2 hours 40 minutes, distance 3.75 miles, we came to a small clearing, — it was the end of the cart-path leading up the Rocky Branch valley. Here we were glad to rest and eat our supper. Nine miles more brought us to Intervale, which we reached at 9.55, or exactly fifteen hours from the summit of Mt. Washington. The distance traversed on the first day was 10 miles; on the second, 6 miles; on the third, 21 miles.

Geodetic Formulæ.

Second Paper.

BY J. RAYNER EDMANDS.

Read May 11, 1881.

IN a preceding paper[1] simplified methods were suggested for calculating the latitude and longitude of a subordinate point (a tertiary station, for example) when its distance and direction from a known point are given. Here a ready method is presented for obtaining the desired quantities without first knowing the distance, the data being the latitudes and longitudes of two or more occupied stations and the azimuths from them to the point sought.

The equations of the preceding paper may be so combined

[1] APPALACHIA, Vol. II. p. 135.

as to give the latitude and longitude of the intersection of two observed lines. Again, they may be so combined, that for an assumed latitude we may calculate the longitude of a point lying on a given line of sight, or that for an assumed longitude the corresponding latitude may be calculated. When there are three or more lines we may calculate the position of the intersection of two of them, and the positions of neighboring points on the remaining lines, or (by obtaining at the start a close approximation for one co-ordinate of the station) we may calculate for each line the position of a point on the line and near the station. Whichever way we proceed, the object is to obtain the data for constructing a large-scale plot covering the vicinity of the station, with a portion of each line of sight represented upon it. On this plot the most probable position of the station is to be selected (by estimating it as nearly as may be), taking into account each plotted line with its due weight; and the co-ordinates of the point thus assumed are to be expressed in the form of latitude and longitude.

With three or more lines the method comprises an "adjustment" adequate to the purpose, although not possessing the precision of the method of least squares. When there are only two lines the advantage lies partly in the ease with which a revised position may be derived at a later date after other lines have been added, and partly in the fact that the length and direction of the base line are not required. Indeed the occupied stations may be tertiaries whose distances and directions from each other have never been calculated.

In a systematic survey one plot would be devoted to each station to be located, and all the plots, on sheets of uniform size, would be kept on file. The back of each would receive such facts, as the dates at which the respective lines were plotted, and at which the successive values for latitude and longitude were assumed as the lines accumulated, together with references to the places where the calculations could be consulted, and to the authorities for the data employed. Numerical values, already found and likely to prove convenient in future computations, would also be recorded on the backs of the plots to which they apply.

Using the notation of the previous paper with some omissions and additions, let L,M, L_1,M_1, and L_1',M_1' denote respectively the latitude and longitude of an occupied station, of the station whose position is sought, and of the origin of the plot, while L_0 denotes the latitude of a point midway between the stations. Let A and B denote the curvatures of the prime vertical, and of the meridian, for the latitude of the occupied station;[1] *i. e.* the number of seconds of arc per meter in length. Let A_1,B_1 and A_0,B_0 denote respectively corresponding quantities for the latitudes of the desired station and of the point midway on the line. (In practice we may use the mean latitude of the stations instead of the latter.) Let Z denote the observed azimuth of the line passing from the occupied station to the other, counted from zero at the south around by the west continuously up to 360°. Let ΔZ denote the *convergence of the meridians*, that is, the variation of the azimuth of the line in moving from the occupied station to that whose position is sought. Distances are in meters, and differences of latitude, longitude, or azimuth are in seconds of arc. North latitude and west longitude are positive, and remarks as to sign apply only to the northern hemisphere.

Before considering the calculations let us follow out the graphical work. The unit for plotting is to be some convenient length for the second of arc of meridian at the latitude of the origin of the plot. Five centimeters (about two inches) to the second of latitude is recommended. Simple rectangular co-ordinates may be used, by expressing the difference of longitude, not in seconds of the parallel, but as the number of seconds of the meridian measuring the same length; *i. e.* [ABSCISSA $= (M_1—M_1')\ (B_1 \cos L_1' \div A_1)$]. Finely executed rectangular paper will prove very convenient for the plotting. The value of $[B_1 \cos L_1' \div A_1]$ is a constant for the particular sheet, and will be repeatedly used. Its logarithm, therefore, should be recorded on the back of the sheet when first found. The directions of the lines are to be constructed by tangents or cotangents of $[Z+\Delta Z]$, remembering that the meridian is the zero of azimuths.

When the collection of lines passing near the point is ex-

[1] See Tables, APPALACHIA, Vol. II. pp. 142, 143.

hibited to the eye, we are concerned not so much with the intersections as with the perpendicular distances from the proposed position of the station to each of the lines. Thus, for three lines of equal weight, we should make these distances equal by selecting the centre of the circle inscribed in the triangle formed by the lines. In general the ideal solution would be to render a minimum the sum of products, formed by multiplying the square of each perpendicular distance by the weight of the line to which it is normal; but no calculations for this purpose are proposed.

If there was a signal on the station when observed, the weight may be diminished as the length of the line of sight increases. The same holds when an instrument of low precision was used without a signal. If an instrument of high precision has been used to observe a mountain summit without a signal, the weight is nearly independent of the distance, as such; but when under these circumstances the summit has been viewed with a considerable angular elevation or depression, the weight may be diminished as the vertical angle (positive or negative) increases in magnitude.

Having selected the position of the station on the plot, its co-ordinates with reference to the origin are to be measured. The abscissa is to be converted into seconds of longitude by dividing by the quantity $[B_1 \cos L_1' \div A_1]$, the value of whose logarithm will have been already found and recorded on the back of the sheet.

Combining equations (1) and (2) of the previous paper so as to eliminate K (the undetermined distance) and solving, we have for the difference of longitude

$$M_1 - M = (L - L_1)\,\frac{A_1 \sin Z}{B_0 \cos L_1 \cos (Z + \frac{1}{2}\Delta Z)} \qquad (14)$$

By analogy with (2) we may write (interchanging stations) $[M - M_1 = AK \sin (Z + \Delta Z \pm 180°) \div L]$. Combining this with (1) so as to eliminate K and solving, we also have for the difference of longitude

$$M_1 - M = (L - L_1)\,\frac{A \sin (Z + \Delta Z)}{B_0 \cos L \cos (Z + \frac{1}{2}\Delta Z)} \qquad (15)$$

For the abscissa to be plotted we have

$$(M_1-M_1')\frac{B_1\cos L_1}{A_1}=(M_1-M)\frac{B_1\cos L_1}{A}-(M_1'-M)\frac{B_1\cos L_1}{A},$$

whence taking $[M_1-M]$ according to (14)

$$\text{ABSCISSA}=(L-L_1)\frac{B_1\sin Z}{B_0\cos(Z+\frac{1}{2}\Delta Z)}-(M_1'-M)\frac{B_1\cos L_1}{A_1}. \qquad (16)$$

Transposing (15_1) we have for the difference of latitude

$$L-L_1=(M_1-M)\frac{B_0\cos L\cos(Z+\frac{1}{2}\Delta Z)}{A\sin(Z+\Delta Z)} \qquad (15_2)$$

The basis for selection between (14), (15_1), and (16), when a longitude computation is to be made, will appear later. Neither would be applied, however, to a line running much nearer to the prime vertical than to the meridian, nor would (15_2) be applied for latitude to a line running much more nearly north and south than east and west.

Approximate latitudes may be used in entering the tables[1] for the curvatures of terrestrial arcs, since their logarithms vary very slowly with the latitude. The ratio $[B_1\div B_0]$ occurring in (16) is nearly unity, and may be neglected in approximate calculations. Excepting for very long lines we may use for more accurate work the value

$$\log\frac{B_1}{B_0}=-\tfrac{1}{2}\varDelta\log B\,.\,\frac{L-L_1}{60} \qquad (17)$$

where $[-\frac{1}{2}\varDelta\log B]$ is half the magnitude of the "Diff. per 1′" tabulated[1] in the column following that of "Log B", where $[(L-L_1)\div 60]$ is the difference *in minutes* between the latitude of the occupied and the observed stations, and where the sign of $[\log(B_1\div B_0)]$ is that of $[L-L_1]$. Notice, however, that the unit of the tabulated value of $[\varDelta\log B]$ is in the fifth decimal place.

The value of the convergence of the meridians is to be taken according to the equation

$$-\varDelta Z=(M_1-M)\sin\tfrac{1}{2}(L+L_1) \qquad (4)$$

For approximate solutions a convenient and easily remembered value of $[\frac{1}{2}\sin\frac{1}{2}(L+L_1)]$ may be used for a section of country embracing several degrees of latitude. For exam-

[1] APPALACHIA, Vol. II. pp. 142, 143.

ple, suppose that an error in $[-\frac{1}{2}\,\varDelta Z]$ not greater than one second per minute of difference of longitude be allowable. Then between latitudes 34°.5 and 39°.3 we may use the relation $[-\frac{1}{2}\,\varDelta Z = 0.3\,(M_1-M)]$, while the relation $[-\frac{1}{2}\,\varDelta Z = 20''$ per minute of difference of longitude$]$ may be used between latitudes 39°.3 and 44°.6. *The sign of $\varDelta Z$ is opposite to that of* $[M_1-M]$.

For the calculation of the longitude of the intersection of two lines let L', M', Z', etc., and L'', M'', Z'' etc, relate to the two lines, the first being that which runs the nearer to the meridian, while L_1, M_1, etc., relate to the intersection. Then we may write

$$M_1 - M' = (L' - L_1)\,Q,$$

where $\quad L' - L_1 = (L' - L'') + (L'' - L_1), \quad$ and where

$$Q = \frac{A' \sin(Z' + \Delta Z')}{B_0' \cos L' \cos(Z' + \frac{1}{2}\Delta Z')} = \frac{A_1 \sin Z'}{B_0' \cos L_1 \cos(Z' + \frac{1}{2}\Delta Z')}$$

according to (15_1) and (14) respectively. Whence

$$M_1 - M' = (L' - L'')\,\frac{A' \sin(Z' + \Delta Z')}{B_0' \cos L' \cos(Z' + \frac{1}{2}\Delta Z')}$$

$$+ (L'' - L_1)\,\frac{A_1 \sin Z'}{B_0' \cos L_1 \cos(Z' + \frac{1}{2}\Delta Z')}$$

In the last term we may put according to (14)

$$L'' - L_1 = (M_1 - M'')\,\frac{B_0'' \cos L_1 \cos(Z'' + \frac{1}{2}\Delta Z'')}{A_1 \sin Z''}$$

Whence finally we have

$$M_1 - M' = (L' - L'')\,\frac{A' \sin(Z' + \Delta Z')}{B_0' \cos L' \cos(Z' + \frac{1}{2}\Delta Z')}$$

$$+ (M_1 - M'')\,\frac{B_0''}{B_0'}\,\frac{\sin Z' \cos(Z'' + \frac{1}{2}\Delta Z'')}{\sin Z'' \cos(Z' + \frac{1}{2}\Delta Z')} \qquad (18)$$

In this we may get $[\log(B_0'' \div B_0')]$ by a process similar to that of (17); namely, multiply the difference *in minutes* between the latitudes L' and L'' by half the tabulated "Diff. per 1'" of $[\log B]$, and give to the product the sign of $[L'-L'']$. A value of M_1 is needed, sufficiently close to give $\varDelta Z'$ and $\varDelta Z''$ by (4) within the errors of observation. A provisional value of M_1 must be used in the last term of (18). Let m_1 denote this value of M_1, while m_2 is the value resulting from the solution. Also let c be the coëfficient of $[M_1-M'']$ in

the last term. Then the error of m_2 will be c times that of m_1. The value m_2 should therefore receive a correction $\left[(m_2-m_1)\div\left(\frac{1}{c}-1\right)\right]$ to obtain which is but the work of a moment, the logarithm of c being already found. Carefully regard signs. Carry the logarithms for the last term of (18) as far as would be done were not the value of M_1 provisional.

Substituting $[\cos(Z'+\frac{1}{2}\varDelta Z')=\cos(Z'+\varDelta Z')]$, in the first term of (18), and in the second term $[\cos(Z'+\frac{1}{2}\varDelta Z')=\cos Z']$ and $[\sin Z''=\sin(Z''+\frac{1}{2}\varDelta Z'')]$, which are the less inaccurate as the lines approach the meridian and the prime vertical respectively, and substituting also $[B_0''\div B_0'=1]$ we have approximately

$$M_1-M'=(L'-L'')\frac{A'}{B_0'\cos L'}\tan(Z'+\varDelta Z')$$
$$+(M_1-M'')\tan Z'\cot(Z''+\tfrac{1}{2}\varDelta Z'') \qquad (19)$$

Suppressing $\varDelta Z'$ in the first term of (19), substituting $[M_1-M''=(M_1-M')-(M'-M'')]$ in the second and solving, we also have approximately

$$M_1-M'=\frac{[(L'-L'')A'\div B_0'\cos L']+(M'-M'')\cot(Z''+\frac{1}{2}\Delta Z'')}{\cot Z'-\cot(Z''+\frac{1}{2}\Delta Z'')} \qquad (20)$$

The preceding equations present a choice of means by which to carry out the calculations; but in any case the work will be easier when we can start with a moderately close estimate. To this end a chart is desirable on which are located all the stations within the area it covers. A scale of 1÷50,000 might serve the purpose. The occupied stations would be laid down by latitude and longitude. The others might be thus laid down after the calculations are made, or they might be constructed by azimuths beforehand. By providing that the observers in the field should construct the azimuths during foggy weather, any failure to intersect, due to gross error in the data, would be discovered, and additional observations would be made; while the existence of the map would induce, and assist in, the search for some points whose visibility might otherwise be overlooked. The laying down of the adopted latitude and longitude of a station whose position

had previously been constructed by azimuths would also serve as a check against gross error in the figures. But these advantages are less important than the fact that the chart would furnish a close first estimate of the desired position. If the azimuths have not been laid off, a fair estimate may still be made by taking on the map a point, so located that the azimuths from the occupied stations shall satisfy the eye.

The accuracy of the formulæ, the admissibility of the assumptions involved in their application, and the use of the tables were so fully discussed in the preceding paper, that it is unnecessary to treat them here. The numerical work, although differing slightly from what was exemplified there, is so similar in character as to render an example of it unnecessary here. But the synopsis of an example will be useful to illustrate the successive steps of the process, and will furnish an opportunity for the reader to test the formulæ numerically. The data are given below.[1]

Station.	Latitude.			Longitude.			Azimuth.		
	°	′	″	°	′	″	°	′	″
Spencer	41	40	41.07	71	29	19.79	298	02	52
McSparran	41	29	44.71	71	27	03.81	240	18	11
Copecut	41	43	15.08	71	03	15.56	46	32	23
Beaconpole	41	59	40.37	71	26	40.36	340	25	41
Pocasset	41	39	07.23	71	11	11.33	33	57	18
Great Meadow . . .	41	52	43.01	71	12	41.29	5	27	51
Quaker	41	34	55.17	71	14	57.82	....		

The first column, headed *Station*, gives the names of six occupied stations, followed by that of the station whose position is desired. In the second and third columns, headed *Latitude* and *Longitude*, are placed the positions of the occupied stations, which are supposed in the example to be given, and also the position of Quaker, which is supposed in the example to be unknown. The last column, headed *Azimuth*, gives the azimuths of Quaker as observed at the six occupied stations. It is to be noticed that a strict accordance of our result with the tabulated position of Quaker is not to be ex-

[1] From U. S. Coast Survey Report, 1851, Appendix No. 12. Azimuths carried only to seconds in copying.

pected, because the above are not all the data bearing upon its position, and also because our computations will be based upon figures for the dimensions of the earth which had not been so accurately obtained as early as 1851. The azimuths, however, are more reliable than will ordinarily occur, since all the lines belong to the primary triangulation.

In order that the points determined by either of the equations (14), (15), or (16) shall lie within the boundaries of the plot, we desire if practicable to have beforehand a close approximation to one of the co-ordinates of Quaker, say within a second of latitude or one or two seconds of longitude. If Quaker had been laid down on a chart with a scale as large as 1 : 100 000, by constructing azimuths, this approximation would be given by direct measurement, although it is not best to make the construction for this purpose only. Possessing even a chart on a scale of 1 : 200 000, with the occupied stations located on it, and avoiding any graphical construction, a mere inspection of the observed azimuths will enable us to select the position within ten or twenty seconds. This will materially help, especially with a line running so near the meridian as does that from Great Meadow, and intersected so favorably as it is by the line from Spencer. Thus starting with $[M_1 = 71° \; 14' \; 40'']$, taking ΔZ equal (for the respective lines) to forty times the number of minutes of $[M_1 - M]$ with the sign reversed, and solving (19) with four decimal places in the logarithms, we obtain $+92''.0$ for the first term and $+45''.0$ for the second, or $[M_1 - M' = +137''.0]$ where M' refers to Great Meadow. Whence we get $[M_1 = 71° \; 14' \; 58''.3]$ within $1''$ of the tabulated value. We are now in a position either to apply (4) and (18) for the precise longitude of the intersection, or (better) abandoning the determination of this, to apply (15_2) to either of the lines from Spencer, McSparran, or Copecut.

Let us suppose, however, that we have neither the map estimate, nor so favorable a pair of lines as those from Great Meadow and Spencer. We then start with a rough estimate of longitude to get $[\frac{1}{2}\Delta Z'']$, and apply (20) to the lines from Beaconpole and McSparran. Assuming roughly $[M_1 = 71° \; 17']$ we thus calculate $[M_1 - M' = -705''.2]$ where M' refers to

Beaconpole. Whence $[M_1 = 71° \ 14' \ 55''.2]$ or about $2''$ away from the tabulated figure. The application of (4) with this value of M_1 will give $[\frac{1}{2}\Delta Z']$ and $[\frac{1}{2}\Delta Z'']$ within $1''$. The precise longitude of the intersection may be then obtained by solving (18). We thus obtain $[M_1 = 71° \ 14' \ 57''.83]$ subject to the correction $[-0''.44]$, giving $[57''.39]$. The latitude of the intersection would then be calculated by applying (15_2) to the McSparran line; and the position thus found would be taken as the origin when the other lines are to be calculated and plotted.

Let us return to the use of (14), (15), and (16). For longitude computation, after the origin has been fixed upon, (16) has the advantage of giving the distance to be taken on the scale in plotting, but (14) or (15_1) may be used to calculate a longitude which is to be assumed as that of the origin. Of these (14) is the less dependent upon accuracy in ΔZ; but (15_1) has the advantage when the errors of observation are liable to be larger than the uncertainty in ΔZ, since the result may be made to conform to an amended latitude by merely changing the logarithm of $[L - L_1]$. In this manner the use of (18), (19), or (20) may be avoided. Thus, suppose that a map has furnished the estimates $[L_1 = 41° \ 34' \ 58''$ and $M_1 = 71° \ 14' \ 55'']$, differing several seconds from the fact, and suppose that the observations are hardly good to single seconds. The estimates being therefore good enough for obtaining $[\frac{1}{2}\Delta Z]$ by (4), the value $[M_1 = 71° \ 14' \ 56''.99]$, obtained by applying (15_1) to the Great Meadow line, will be sufficiently accurate for the longitude of the point (on that line) whose latitude is $[41° \ 34' \ 58''.00]$; but this latitude will be beyond the convenient limits of a plot. With this value of M_1 we should then solve (15_2) for the Spencer line, obtaining $[L_1 = 41° \ 34' \ 55''.02 = L_1']$; *i. e.* it is taken as the latitude of the origin. We may now quickly amend the result of (15_1) for the Great Meadow line in accordance with the new value of L_1, obtaining $[M_1 = 71° \ 14' \ 57''.67 = M_1']$; *i. e.* it is taken as the longitude of the origin. The point on the Great Meadow line will then lie upon the origin, while the point on the Spencer line will have an ordinate zero and an abscissa

[56.99—57.67 = —0.68] in seconds, or [—0.68 ($B_1 \cos L_1' \div A_1$) = —0.51] in units of the plot. It will always be found convenient to arrange that every point shall lie upon one or other of the co-ordinate axes.

Enough has been written to show that the method can be planned to easily deal with any case which may arise. In conclusion it may be remarked that the length of the discussion has been caused by this adaptability, rather than by any complexity in dealing with a case in hand. The method is possibly less fitted in general for routine calculations, done according to specific directions issued from the headquarters of a large survey, than it is for the use of persons who have their own computations to make in extending the results of the larger survey. But where a routine is made of constructing the azimuths and measuring the resulting positions on a chart, the dependence upon the judgment of the computer reduces to a minimum, and the operation, except the final selection of the position on the plot, becomes a simple routine. In comparing the aggregate work with that by the old process, it must be remembered that the whole work of computing the triangle sides is saved.

Proceedings of the Club.

July 20, 1880. — Tenth Field Meeting.

Held at the State Normal School, Plymouth, N. H.

President Cross in the Chair.

The President opened the meeting with a few remarks on the nature and objects of the Club, and alluded to the recent death of Count Pourtalès, a member of the Club, and its first Councillor of Exploration.

Col. T. W. Higginson read an account of an ascent to the Grand Mulets, on the side of Mont Blanc.

Prof. W. H. Niles added an account of some of his Alpine experiences.

Mr. H. P. Warren spoke of the characteristics of the portion of Maine adjacent to the White Mountains.

Prof. C. E. Fay read an account of a trip from Warren to Campton, over Mt. Kineo.

Mr. A. E. Scott gave an account of his recent exploring expedition from Conway to Warren by way of the Swift River, Mt. Tripyramid, Waterville, Campton, Thornton, and between Mts. Cushman and Kineo.

Rev. Mr. Scott, of Plymouth, described a visit to a series of seven fine cascades on the easterly side of Mt. Moosilauke, which it was proposed to name "The Pleiades."

Mr. J. R. Edmands described the method of using the heliotrope for mountain work, and urged the desirability of certain work of that kind in connection with the occupation of Mt. Washington by the United States Coast and Geodetic Survey.

Prof. E. T. Quimby, of this Survey, added a few suggestions with regard to the work.

Mr. Warren called attention to the beauties of the mountain region in winter, and urged all who could to pay it a visit at that time.

July 21, P.M. — A party of some twenty-five persons ascended Mt. Prospect, and, besides enjoying the remarkably fine view, had an opportunity of witnessing the operations of a working party of the topographical section.

July 22. — About fifty persons, members of the Club and their guests, made an excursion to the summit of Mt. Moosilauke.

September 2, 1880. — By the courtesy of the Eastern Railroad, the Club, which had proposed to hold a field meeting at this time, joined the excursion to the White Mountains given by that Corporation to the members of the American Association for the Advancement of Science, and acted as their escort. The excursion lasted three days. On the evening of Thursday, the 2d, there was held, at the Fabyan House, the

Eleventh Field Meeting.

President Cross in the Chair.

The President opened the meeting with some remarks on the nature and objects of the Club, and welcomed the members of the American Association, as its guests.

Prof. George H. Barker, of Philadelphia, retiring President of the Association, responded in its behalf.

Prof. C. H. Hitchcock described a newly discovered cave, which had been named "Hellsgate Cave," near Maidstone Lake, in Vermont.

Prof. E. T. Quimby spoke of the United States Coast and Geodetic Survey in New Hampshire, and the connection of the Club with it.

Prof. H. E. Nipher spoke of the lines of magnetic variation in Missouri.

Prof. F. W. Clarke spoke of the natural beauties of the Island of Grand Menan.

The topographical camera and Prof. Morse's pack-saddle for pedestrians were described and exhibited for the benefit of members of the American Association.

September 3 and 4. — A party of about forty ladies and gentlemen ascended Mt. Washington, some by rail, and some on foot by the Crawford path. About half the number remained over night at the Summit House and descended the following morning by way of Tuckerman's Ravine and the Club path to the Glen road. Here they were joined by another party, which had descended to the Glen house by the carriage road, and proceeding to Glen Station took cars for Boston.

A small party spent the two days in excursions to Mt. Willard and points of interest near the Crawford House.

October 13, 1880. — Twenty-third Corporate Meeting.

President Cross in the Chair.

Forty-two candidates for membership were nominated, and four presented at the last meeting were elected.

Mr. Edmands stated that recent observations had shown that Mt. Wachusett was visible from Mt. Washington, lying 1° 14′ west of Mt. Whiteface, instead of being hidden by the latter, as previously supposed.

Professor Lanza read a paper describing "A Sojourn in Andover, Me.," and visits to the points of interest in that vicinity. (See p. 246.)

Professor Fay read two papers by Mrs. Pychowska, one concerning Bald Hill, near Campton, N. H.; the other an account of Loon Pond Mt., near North Woodstock. (See p. 284.)

Mr. W. H. Pickering read an account of a three days' trip, in which he visited Carter Dome, Huntington's Ravine, and the Montalban Ridge. (See p. 345.)

Professor Fay described a visit made by Professor Cross and himself to a peculiar feature on the westerly spur of Mt. Lincoln, which proved to be a deep rocky trough at the head of one of the tributaries of the stream that crosses the stage-road near the old Lafayette House; also, their return to the Profile House by way of this stream. (See p. 286.)

November 10, 1880. — Twenty-fourth Corporate Meeting.

President Cross in the Chair.

Fifteen candidates for membership were nominated, and those presented at the last meeting were elected.

Mr. W. H. Pickering presented his report as Councillor of Exploration. (See p. 281.)

Mr. J. R. Edmands gave an account of the geodetic work done during the past summer. (See p. 279.)

Judge J. W. Bacon spoke of some birds met with on Mt. Osceola last summer, which were strange to him and his companions, and which proved to be Canada jays. They were especially noticeable for their tameness.

The President read an account from the "London Times" of the recent ascent of Mont Blanc by Mr. Campbell, a blind man, an American resident of London.

Prof. E. C. Pickering called attention to the desirability of taking some measures looking to the preservation of the records made by visitors to the summits of mountains.

After some discussion, it was voted, on motion of Mr. Edmands, to refer the subject to a committee consisting of Professor Pickering, Mr. A. E. Scott, and a third to be named by the Chair. The Chair named Mr. Edmands.

President Cross gave an account of a visit made to the Giant's Stairs last summer.

December 10, 1880 (Evening). — Twenty-fifth Corporate Meeting.

President Cross in the Chair.

Four candidates for membership were nominated, and those presented at the last meeting were elected.

Mr. C. W. Folsom, Dr. Parker, and Miss Whitman were appointed a committee to make nominations for officers to be elected at the next meeting.

Messrs. Fay and Curtis, Mrs. Kendall, Miss Pitman, and Miss Littlehale were appointed a committee to make arrangements for a social meeting of the Club.

Mr. Scott presented his report as Councillor of Improvements. (See p. 290.)

Mr. Harold Murdock read a paper on Mt. Cardigan, including accounts of several ascents. (See p. 239.)

Lieutenant Russell, of the Watertown Arsenal, described several forms of portable telemeter.

Professor Lanza exhibited and described two forms of crossed prisms, by means of which a number of simple problems in surveying could be solved with sufficient accuracy for many purposes.

January 12, 1881. — Twenty-sixth Corporate Meeting.

President Cross in the Chair.

Two candidates for membership were nominated, and those presented at the last meeting were elected.

The following officers for the ensuing year were elected: President, Charles E. Fay; Vice-President, William H. Niles; Recording Secretary, Rest F. Curtis; Corresponding Secretary, J. Rayner Edmands; Treasurer, Charles W. Folsom. Councillors: Natural History, J. H. Huntington; Topography, Edward C. Pickering; Art, Miss Susan Hale; Exploration, William H. Pickering; Improvements, A. E. Scott.

During the balloting for officers, Mr. J. R. Edmands read a paper on Schemes for Appalachian Maps, in which he recommended that the Club cause to be prepared a sufficient number of permanently mounted sheets, upon which the results of work done should be plotted according to a uniform plan.

On motion of Prof. E. C. Pickering, it was voted to appoint a committee of ten to consider the recommendations of Mr. Edmands, of which the President of the Club should be one, the others to be appointed by the Chair. The committee was constituted as follows: Professors C. R. Cross, C. E. Fay, E. C. Pickering, W. H. Niles, and G. Lanza, and Messrs. S. H. Scudder, J. B. Henck, Jr., C. W. Folsom, W. H. Pickering, and J. R. Edmands.

The Recording Secretary read his report for the year. (See p. 268.)

Mr. R. F. Curtis presented his report as Corresponding Secretary. (See p. 270.)

Mr. C. W. Folsom presented his report as Treasurer. (See p. 272.)

The result of the election was announced, and President Fay took the Chair.

President Cross then delivered the annual address, his subject being a History of the Barometric Measurements of Heights.

On motion of Mr. R. F. Curtis, a vote of thanks was passed, and Professor Cross was requested to furnish a copy of his address for publication. (See p. 201.)

On Wednesday evening, Jan. 19, 1881, the Club held its Second Annual Reception at the Revere House. About one hundred ladies and gentlemen, including several invited guests, were present, and the evening was pleasantly passed in social intercourse, varied with music and a collation.

February 9, 1881. — Twenty-seventh Corporate Meeting.

President Fay in the Chair.

Two candidates for membership were nominated, and those presented at the last meeting were elected. Prof. A. E. Nordenskiöld, of Stockholm, Mr. Edward Whymper, of London, Lieut. Frederick Schwatka, of Washington, and Mr. J. G. Whittier, of Amesbury, were nominated for corresponding membership.

During the election of members, a short list of barometric measurements of heights in the vicinity of Campton, N. H., calculated by Mr. E. B. Cook, of Hoboken, N. J., was presented by the President.

Mrs. Maria E. McKaye read a paper on Lake Dunmore, in Vermont, and remarks were made by the President and Prof. Niles. (See p. 297.)

The President then read a letter from Mr. J. G. Whittier, expressing interest in the work of the Club; one from Miss Lucy Larcom, touching the name of Mt. Wonnalancet, incorrectly located on all maps; and a third from Mr. Charles Cutter, of Campton, N. H., with regard to the region through which the new Warren-Thornton path passes. Remarks suggested by the last letter were made by Messrs. Edmands, Scott, and W. H. Pickering on the desirability of using existing logging roads in connection with Club paths.

Professor Niles made some remarks on a visit to the mountain region in winter, and concerning landslides.

March 9, 1881. — Twenty-eighth Corporate Meeting.

President Fay in the Chair.

Four candidates for membership were nominated, and those nominated for corresponding and corporate membership at the last meeting were elected.

The Corresponding Secretary made some remarks on our exchanges with foreign publications, and announced the receipt of letters accepting the proposition for exchange from the following societies: —

Gesellschaft für Erdkunde (Berlin).

Société de Géographie Commerciale de Bordeaux.

Club Alpin Suisse, Section Genevoise.

Club Alpin Français, Section de Saône et Loire.

Deutscher und Oesterreichischer Alpenverein, Section Frankfurt a. M.

Prof. E. C. Pickering, for the Committee on the Preservation of Records on Summits, appointed Nov. 10, 1880, presented a report, recommending that the present records be replaced next summer by copies, and that the originals be preserved among the archives of the Club. The report was accepted, and referred to the Councillor on Improvements.

Professor Pickering also, for the Committee on Schemes for Appalachian Maps, appointed January 12, presented a report, approving the general plan of permanent sheets offered by Mr. Edmands at the January meeting. It also urged the desirability of an appropriation of funds in order to secure the reduction of topographical observations already obtained, and recommended soliciting a subscription for carrying out the plan of permanent sheets ; further, that the executive authority over the sheets be lodged with a small committee of long tenure, to be appointed by the Council. The report was accepted.

On motion of Mr. C. W. Folsom, the following were appointed a committee to raise subscriptions for the purpose recommended in the last-named report : Professors W. H. Niles, G. Lanza, C. E. Fay, C. R. Cross, J. B. Henck, Henry W. Haynes, Messrs. C. W. Folsom, Henry P. Curtis, W. H. Pickering, and J. R. Edmands.

Rev. Edward E. Hale gave an account, entitled "The White Mountains a Generation Ago," of a trip made by himself and Dr. William F. Channing, of Providence, R. I., in 1841, while on the Geological Survey of New Hampshire, from Jefferson up the South Branch of Israel's River, in search of sheets of mica of immense size alleged to have been found there, and continuing up and over Adams and Washington, and returning next day to the old Fabyan tavern.

In reply to a question of Mr. Hale, Professor Niles made some remarks on the method of arrangement of the fragments of rock which cover the summits of some of the White Mountains.

Remarks were also made by President Fay. A vote of thanks to Mr. Hale, for his address and for a view of the old "Tip Top House," Mt. Washington, presented to the Club, was passed.

President Fay then read a paper, entitled "The Love of Nature among Americans ; a Reply to Strictures by Mr. Grant Allen." (See p. 255.)

April 14, 1881 (Evening). -- Twenty-ninth Corporate Meeting.

President Fay in the Chair.

Eighteen candidates for membership were nominated, and those presented at the last meeting were elected.

The Corresponding Secretary reported that further acceptances of the proposition for exchange of publications had been received from the following foreign societies : —

Société Khédiviale de Géographie (Cairo, Egypt).

Club Alpin Français, Section d'Auvergne.

Deutscher und Oesterreichischer Alpenverein (Central Ausschuss, Wien).

The Corresponding Secretary also announced that letters had been received from Professor Nordenskiöld, Mr. J. G. Whittier, and Lieutenant Schwatka, accepting their election as corresponding members.

The Committee on Field Meetings reported that it was proposed to have a field meeting of the Club in July, at Jackson, N. H., and also one in September, at Bethlehem, N. H.

The Committee on Spring Excursions reported that arrangements were being made for an excursion on June 17 to Williamstown, Mass.

Prof. J. H. Huntington presented his report as Councillor of Natural History.

Prof. Charles E. Hamlin read a paper on "Mount Ktaadn," illustrated by a model of the mountain, of his own construction.

May 11, 1881. — Thirtieth Corporate Meeting.

President Fay in the Chair.

Eighteen candidates for membership were nominated, and those presented at the last meeting were elected.

The Corresponding Secretary read a letter, received from Lieutenant Schwatka, presenting to the Club two walrus tusks, which were exhibited. He also read a circular announcing the incorporation of the Middlesex Institute.

Announcements were made, by the Committee on Excursions, of the particulars of an excursion to Doublet Hill in Weston on May 21, and those of the Williamstown excursion.

The report of the Councillor of Topography, Prof. E. C. Pickering, was read, in his absence, by the President.

Miss Susan Hale presented her report as Councillor of Art, urging upon the members the practice of sketching during the summer, and offering her assistance to any desiring it. Remarks were made, and some profile sketches from foreign magazines were shown.

Mr. W. H. Pickering presented his report as Councillor of Exploration.

Mr. J. R. Edmands presented, by title, a paper on Geodetic Formulæ. (See p. 351.)

May 21, P. M. — The weather being quite doubtful, a party of only eighteen made the excursion to Doublet Hill in Weston.

June 8, 1881. — Thirty-first Corporate Meeting.

Vice-President Niles in the Chair.

Sixteen candidates for membership were nominated, and those presented at the last meeting were elected. Dr. E. Behm of Gotha,

Germany, and Prof. S. P. Langley of Allegheny, Pa., were nominated for corresponding membership.

A letter was read from Mr. C. W. Folsom, resigning his position as Treasurer of the Club. The resignation was accepted, to take effect on the appointment of his successor.

On motion of Mr. A. E. Scott, it was voted that the election of a Treasurer take place at the next regular meeting; that the Recording Secretary be instructed to give five days' notice of the same; and that a committee of three be appointed to present a nomination at that time. The Chair appointed Prof. E. C. Pickering, Mr. A. E. Scott, and Dr. W. B. Parker.

On motion of Prof. Pickering, a vote of thanks to Mr. Folsom was passed for his very efficient services as Treasurer.

Mr. A. E. Scott presented his report as Councillor of Improvements.

Mr. J. R. Edmands exhibited and described a new cabinet of frames for Appalachian Maps, constructed in pursuance of suggestions made in his report to the Club at the January meeting.

The Corresponding Secretary reported that a circular-letter had been received from the *Club Alpino Italiano*, announcing an international congress of Alpine Clubs to be held in Milan, from August 30 to September 3 of the present year; and also a preliminary circular from the Central Committee of the *Deutscher und Oesterreichischer Alpenverein*, announcing a similar Congress for August 1882.

Prof. J. H. Huntington presented his report of the work done in the department of Natural History in the summer of 1880.

Mr. Harold Murdock read a paper on the region surrounding the Smith's River valley in New Hampshire.

Mr. S. H. Woodbridge gave a description of the country adjacent to Williamstown, Mass., including the Hoosac and Taconic mountains, Greylock, etc., illustrated by lithogrammed maps, which were distributed to those present.

On Friday, June 17, a party of about one hundred and ten, members of the Club and their friends, made the excursion to Williamstown, taking special cars over the Fitchburg Railroad. About ninety of the party left the train at the east end of the Hoosac Tunnel, and after lunch, and a visit to the fine cascades near by, were driven over the Hoosac Mountain to Williamstown. On Friday evening an informal meeting was held in the parlor of the Mansion House, at which many of the residents were present. The Club was happily entertained, largely by gentlemen connected with Williams College. Ex-President Hopkins welcomed the party in a genial address, which was answered by Prof. Fay, President of the Club. Dr. Chadbourne gave an account of the flora of the surrounding region. Prof. Perry made an address on the history of the region, referring to the settlement of the boundary line between Massachusetts and New Hampshire in the last century. Re-

marks were made by Prof. Hitchcock, on the geology of the region; also by Rev. Mr. Sewall, and others.

On Saturday morning, a party of about seventy made an excursion to Bald Mountain and Greylock, obtaining fine views of the surrounding country. Most of the party returned to Boston by the afternoon train. Quite a number, however, remained over Sunday, and the ascent of Berlin Mountain was made by several on Monday.

July 19, 1881. — Twelfth Field Meeting. Held at the Village Church, Jackson, N. H.

President Fay in the Chair.

The President made a brief address, especially relating to the objects, history, and present condition of the Club. Prof. Chas. R. Cross was elected Secretary *pro tem.*

It was announced that the Council had appointed Mr. J. B. Henck, Jr., to represent the Club at the Congress of Alpine Clubs, to be held at Milan in September.

A paper was read by Mr. J. R. Edmands upon the region around Moat Mountain.

Two letters, written in 1853 by Dr. T. W. Harris of Cambridge and by Dr. Charles Pickering of Boston, were then read by Prof. E. C. Pickering. They treated of early ascents of Mt. Washington, and particularly of that made by Dr. Pickering in 1825.

A paper was read by Mr. S. H. Scudder, upon the Banded Purple Butterfly, *Basilarchia Arthemis*, explaining its growth, and discussing some remarkable examples of mimicry. (See p. 331.)

The Corresponding Secretary read a letter from Miss Frances Willard, and also one from Gen. Cruft of Bethlehem, regarding a change of name of the Haystack Mountain (Franconia) to "Mt. Garfield."

Resolutions favoring the change, if initiated by the inhabitants of the region, were submitted by Mr. C. W. Kennard.

On motion of Mr. Scott, it was voted to refer these resolutions to a committee of three, to be appointed by the Chair, to consider the matter and report at the Bethlehem meeting, after ascertaining the opinions of the people in the locality.

The Chair appointed Messrs. Scott, Kennard, and E. C. Pickering.

A communication concerning the introduction, among the White Mountains, of Swiss travelling chairs for the benefit of infirm tourists, was presented by Mr. Edward Shippen of Philadelphia.

July 19, P. M. — A party of some seventy-five members of the Club and their friends went up Thorn Mountain, near Jackson. They were favored with a fine view, the day being quite clear.

July 20. — A party of forty, of whom fourteen were ladies, made the trip from Jackson, through Carter Notch, to the Glen House, arriving there about 6 P. M. Twelve of the party also included the ascent of Carter Dome in their day's excursion.

In the evening, an informal meeting was held at the Glen House. The President made a few introductory remarks. The Corresponding Secretary read a letter from Mr. C. F. Lummis on the condition of the Old Man of the Mountain, stating the necessity of taking measures for its preservation. On motion of Mr. J. R. Edmands, it was voted that the matter be referred to the Councillor of Improvements.

July 21. — A party of eight explored the Great Gulf on Mount Washington, leaving the Glen House at 10:30 A. M. and arriving at the summit at 5:30 P. M. The day was showery, but the party found the trip a very interesting one, especially on account of the cascades, which were quite full.

September 6, 1881. — Thirteenth Field Meetiug.

Held in the Hall of the Maplewood Hotel, Bethlehem, N. H.

President Fay in the Chair.

The President made an opening address on the nature and objects of the Club, comparing it with similar organizations elsewhere.

The Councillor of Improvements, to whom was referred the matter relating to the condition of the Old Man of the Mountain, and its preservation, reported that he had made a personal examination of the profile, and believed that the forehead was in danger of injury, if not destruction, unless something was done to prevent the destructive action of frost, but that the proprietors of the Profile House had assured him that everything feasible should be done to protect it, before the close of the season. The report was accepted.

Mr. Samuel Adams Drake read a paper on "Robert Rogers, the Hunter of the White Hills."

Mr. W. H. Pickering read an account of the exploration of the Great Gulf between Mt. Washington and Adams, by a party of Appalachians, after the field-meeting in July of the present year.

Rev. Almon Gunnison read a paper entitled "A Night on the Greeley Path."

Prof. E. C. Pickering read a communication in which he recommended the construction of a path from the railroad to the top of the Twin Mountains, and offered to be one of ten to defray the expense of constructing such a path. Mr. Addey of Bethlehem and Dr. Dix of Boston each subscribed five dollars towards the enterprise. The matter was referred to the Councillor of Improvements.

The Councillor of Improvements read a letter from two members of

the Club, representing the desirability of constructing a path to Bridal Veil Falls, on Mt. Kinsman.

Mr. A. E. Scott, for the committee to whom was referred the Resolutions relating to the substitution of the name "Mt. Garfield" for the peak of the Lafayette Lincoln Range at present known as "Haystack," or "Hooket Mountain," presented the following Report:—

"While the Appalachian Mountain Club does not assume to change the well known names of mountains, it is always ready to join with those having authority, or who are most interested, in giving effect to changes obviously in the direction of improvement.

"The authorities of the town of Franconia, who claim the right under the Statutes of New Hampshire, having taken the steps requisite to the proposed change, it is resolved that we will cheerfully favor the general adoption of the name, as soon as the action of the town is fully ratified."

The report was accepted and adopted. A vote of thanks was passed for a bound volume of the "White Mountain Echo," presented to the Club, by Mr. Markinfield Addey.

September 7.—A party of thirty made an excursion by carriage from Bethlehem to the various points of interest in the Franconia Notch, six of the party making the ascent of Mt. Lafayette. Before returning, the party lunched at the Profile House, by invitation of Messrs. Taft & Greenleaf, the proprietors of that hotel.

September 8.—A party of eight ascended Mt. Washington, and were favored with a magnificent view, the day being one of the clearest of the season. On the same day a party of twenty visited Lancaster, and enjoyed the view from Prospect Hill. On the following day twelve of the same party ascended the Percy Peaks in Stratford.

The hospitality of the Boston, Concord & Montreal Railroad was generously extended by its manager, Mr. J. A. Dodge, to the party visiting Lancaster and Stratford.

October 12, 1881.—Thirty-second Corporate Meeting.

President Fay in the Chair.

Fifty candidates for membership were nominated, and those presented at the last meeting, including two for corresponding membership, were elected.

Prof. E. C. Pickering, for the committee appointed at the June meeting to present a candidate for Treasurer in place of Mr. C. W. Folsom, resigned, reported the name of Mr. Chas. W. Kennard as their nomination.

Mr. Kennard was unanimously elected by ballot.

The matters of treasurer's bond and clerk hire were referred to the Council.

The Committee on Excursions reported the details of a trip to the Uncanoonuc Mountains, in Goffstown, N. H., proposed for the 15th inst.

Mr. W. H. Pickering made some remarks concerning the probable view from the summit of the southern peak, and distributed among those present a theoretical view of the White Mountains as seen from that point.

Mr. J. R. Edmands presented the following resolutions: —

"The Appalachian Mountain Club desires to express publicly its grateful acknowledgment of the kind hospitality shown to the members of the excursion party by Messrs. Taft & Greenleaf, proprietors of the Profile House, N. H., on the occasion of the recent meeting of the Club at Bethlehem.

"Thanks are also tendered to the Boston, Concord & Montreal Railroad, for favors extended to the Club on the same occasion."

Mr. S. H. Scudder moved the adoption of the resolutions. The motion was carried.

It was voted that copies of the above resolutions be forwarded to Messrs. Taft & Greenleaf, and the proper authorities of the Boston, Concord & Montreal Railroad, and that they be published in the Boston Transcript, and Advertiser, and New York Evening Post.

Mr. W. H. Pickering gave an account of a trip taken during the summer, over Mts. Passaconaway and Whiteface.

Mr. S. H. Scudder gave an account of some of the mountains in the vicinity of Moosehead Lake.

Prof. Fay gave an account of the discovery, by Mr. Chas. E. Lowe and himself, of a natural camp in King's Ravine.

On Saturday, Oct. 22d, the weather of the preceding Saturday having proved unfavorable, a party of more than fifty members of the Club and their friends made an excursion to the Uncanoonucs, — by special car to Manchester N. H., and thence eight miles by carriages to the base of the mountain. They were met on the summit by citizens of Manchester and Goffstown, who accorded them a warm welcome, and expressed their gratification that the Club had thus recognized the beauty and interest of a mountain view so readily accessible from Boston.

November 9, 1881. — Thirty-third Corporate Meeting.

President Fay in the Chair.

Thirteen nominations for membership were made, and those nominated at the last meeting were all elected.

The following vote, passed by the Council, was read to the Club: —
"Voted that the Council deem it inexpedient to require a bond of the Treasurer."

The President reported that progress was being made in the preparation of APPALACHIA, Vol. II., No. 4, and in the arranging and cataloguing of the library.

Prof. J. H. Huntington presented his report as Councillor of Natural History.

Prof. E. C. Pickering presented his report as Councillor of Topography.

Mr. W. H. Pickering presented his report as Councillor of Exploration.

Mr. F. W. Parker gave an account of a recent trip through the region north of Moosehead Lake.

Mrs. R. A. Bradford read a paper entitled "A Sketch of the Ascents of Bald and Berlin Mountains," with special reference to the visit of the Club to Williamstown in June last.

Mr. S. W. Holman added an account of some hypsometric measurements that had been taken on those, and neighboring mountains, during the summer, presenting a tabulated view of the results.

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APPALACHIA

DECEMBER, 1881

BOSTON
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Some Adirondack Paths: Climbs about the Keene Valley. By F. W. FREEBORN. 18°, pages 20, with sketch-map and one plate, 15 cents.

Preliminary Charts of the Positions of White Mountain Summits. Scale 1 : 50000. 1886. Two sheets of blue prints. $1.30.

Map of Williamstown and Greylock. 1886. Executed by the United States Geological Survey. Scale 1 : 30000. 25 cents.

Map of the White Mountains. 1887. (Location of summits only vouched for by the Club.) Scale 1 : 150000. 1887. 50 cents. The Same. Scale 1 : 100000. 50 cents.

Map of the Country about Boston. 1890. Executed by the United States Geological Survey. Scale 1 : 62500. Unmounted, 25 cents; on cloth, 60 cents; on roller, 75 cents. (Nearly out of print.)

Map of the Country about Worcester. 1891. [Like the preceding.] Unmounted, 25 cents; on cloth, 75 cents; on roller, $1.25.

Map of Monadnock Mountain (N. H.). 1891. Executed by the United States Geological Survey. Scale 1 : 20000. 25 cents.

Middlesex Fells, with a map. By R. B. LAWRENCE. 1886. 8°. (Out of print.) The Same, revised edition. 1892. 25 cents.

Map of the Country about Boston. 1896. Executed for the Metropolitan Park Commission. Scale 1 : 62500. Unmounted, 25 cents; on cloth, 60 cents.

Walks and Rides round about Boston. 16°, pages 410, with 150 illustrations in the text and four folded maps. 1897. $1.25. The same, published in handy sectional parts, in paper covers. 1900. 25 cents each.

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Subscriptions to Appalachia may be sent to the Corresponding Secretary of the Club, Mass. Institute of Technology, Boston, Mass. Back numbers of this volume, and of part of Vol. I., may be obtained. Price of each number, 50 cents.

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